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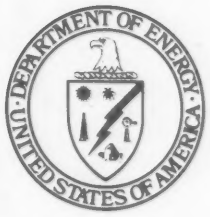
Vol. 13, No. 10
May 31, 1988

Energy Research Abstracts

Abstracts 24048-25691



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Vol. 13, No. 10
ISSN: 0160-3604
CODEN: ERABD
May 31, 1988

ENERGY RESEARCH ABSTRACTS

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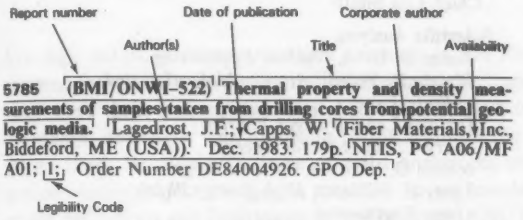
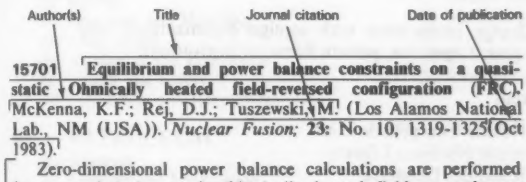
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



5785 (BMI/ONWI–522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; Order Number DE84004926. GPO Dep.

Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.



15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **23:** No. 10, 1319-1325 (Oct 1983).

Abstract

Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

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Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI–522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI–522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI–522	9:5785	NTIS, PC A09/MF A01. Order Number DE84004926, Distribution Category MN-70

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IEA Biomass Conversion Service
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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

0103 Preparation

24048 **(EPRI-CS—5552) Guidelines for fireside testing in coal-fired power plants: Final report.** Sotter, J.G. (Energy and Environmental Research Corp., Irvine, CA (USA)). Mar 1988. 483p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920228/JAW.

The objective of this project was to develop guidelines for testing the performance impacts of coal quality on three major power plant components: the pulverizer, the steam generator, and the electrostatic precipitator. Part 1 of these guidelines is an introduction and summary. Part 2 defines the relevant performance parameters, instrumentation, and comprehensive test procedures for their measurement to help utilities make decisions involving coal purchase, plant improvements, operating procedures, and maintenance plans for burning various coals. Part 3 documents instrumentation and test procedures for measuring key process parameters which are needed by researchers engaged in understanding the fate of coal and its mineral matter in power plants. Selected electric utilities were contacted in the United States, Australia, Canada, Denmark, and the United Kingdom, as well as equipment manufacturers, in order to determine the equipment and test procedures which had already proven useful. Additional test development or test improvements are suggested where there are gaps in the state-of-the-art. 107 refs., 8 figs.

24049 **(NRCC—26605) Overview of Canada's Peat Program.** Tibbetts, T.E. (National Research Council of Canada, Ottawa, Ontario). Apr 1986. 100p. (In French). (MICROLOG—87-04636). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This project provides an overview of the Peat Program of Canada: its structure, purpose, objectives, and activities. Also included is an introduction to peat as an energy source, a description of extraction methods, the treatment of peat and environment effects of peatland development. Biogasificataion, anaerobic fermentation and the use of peat extracts or pressate as a feed stock are described with research programs within these area further detailed.

24050 **Explosive boiling of coal-water slurry droplets exposed to infrared radiation.** Sitarski, M. (Clarkson Univ.). pp 1 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Among the multiphase particles of interest for fossil fuels technologies, the coal-water slurry (CWS) microdroplets have recently received much attention. During combustion they are exposed to the well-absorbed, high intensity infrared radiation. Depending on how deep the radiation penetrates the droplets, it can trigger a number of technologically important phenomena. One of them is explosive boiling of water followed by fragmentation of the droplet. The layered-spheres models and effective medium theories have been applied in studies of dissipation of the electromagnetic energy inside the CWS droplets. The obtained three-dimensional plots of the heat source function, by application of different models of light absorption inside the droplets, show the nonuniform nature of the absorption and depict hot spots where the liquid can be heated beyond the range of metastable state. Based on the heat transport model and the temperature history in the hot spots, the threshold intensities of the infrared radiation causing explosive boiling of the CWS fine droplets have been estimated theoretically.

0104 Processing

REFER ALSO TO CITATION(S) 24049, 24081, 24396, 24937

24051 (CONF-860294—, pp 75-83) **Fractionation and identification of liquid coal degradation products, using the example of tars from Fischer carburisation and hydropyrolysis.** Kirschstein, J.; Haedicke, A. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

Two separation processes are described, one of which had promising results. A modification of the solvent composition and subfractionating of the sulphur components using PdCl/sub 2/ on silicon gel is recommended. With regard to the biomarkers, pyrolysis can be improved, especially in temperature-sensitive materials, by more careful coal extraction. Higher reliability is achieved by considering other spectroscopic methods and by using reference substances to determine the retention times.

24052 (CONF-860294—, pp 95-103) **Identification of products of high-speed pyrolysis of coal (Curie point pyrolysis).** Kaiser, M. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

Coal pyrolysis and hydropyrolysis is investigated as an alternative to direct hydrogenation and gasification followed by Fischer-Tropsch synthesis. This requires sound knowledge of the reaction process. The reaction can be described on the basis of an extensive analysis of the pyrolysis products. Specially developed routine methods are presented.

24053 (CONF-860294—, pp 105-112) **Liquid pyrolysate yields of multistage pyrolysis as a function of coalification in Saar coal.** Wissing, L. (Technische Hochschule Aachen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The pyrolysate yield was found to increase with the coalification rate in the Saar coals investigated. Pyrolysate production had a peak in a narrow temperature range around 400/sup 0/C. Depth and coal alginite fractions seemed to have no effect on the pyrolysate yield. Useful maturity parameters in the Saar coals were the R/G quotient of telocollinite and desmocollinite and organic carbon concentration.

24054 (CONF-860294—, pp 159-171) **Transfer of laboratory findings on coal pyrolysis kinetics to in-situ reactions.** Heek, K.H. van; Kassler, P.; Wanzl, W. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The experimental and theoretical methods described provide a methodological and data basis for calculations on in-situ pyrolysis, although there are some limitations concerning hydrogen formation. An essential precondition of pyrolysis is the heating of seams, or seam regions, to the desired temperature range. All calculations carried out so far have neglected the generation and transfer of the heat and assured a heating rate at random. It is evident that the heat transfer conditions in coal seams must be known for a feasibility analysis of in-situ pyrolysis.

24055 (CONF-860294—, pp 173-191) **Thermodynamic investigation of coal in-situ pyrolysis.** Bassiouny, M.K.; Martin, H. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Thermische Verfahrenstechnik). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

Model calculations show that considerable amount of gas (mostly hydrogen and methane) are released when a coal seam is heated to temperatures of 250 to 350/sup 0/C. The feasibility of in-situ pyrolysis depends on how the coal and the surrounding rock can be heated up. Calculations will be carried out to this end using the available energy from different sources and the energy required for pyrolysis (heat sink) as boundary conditions. This necessitates the establishment of suitable model assumptions, the determination of the parameters required, and the development of computer programs simulating the development with time of temperature fields in bedrock and coal. The investigation was to develop mathematical models for a feasibility analysis of in-situ pyrolysis projects.

24056 (DOE/PC/50033—T19) **Syn-fuel Reciprocating Charge Pump Improvement Program: Final report, October 1982 to August 1987.** Bonney, G.E. (Ingersoll-Rand Co., Phillipsburg, NJ (USA). Pump Group). 1987. Contract AC22-82PC50033. 124p. NTIS, PC A06. Order Number DE88000935/JAW.

Reciprocating slurry pumps employed in the conversion of coal to liquid fuels handle hot abrasive coal slurries, up to 3000 psig. The object of the final phase of this program was to investigate the floating piston concept, fully described in the previously issued Topical Report, at higher rubbing speeds and oriented both vertically and horizontally. Testing was conducted with a 20% by weight sand-water slurry to provide an aggressive wear medium and result in accelerated wear effects. Limited testing was carried out on a 10% by weight diatomaceous earth and water slurry in hopes of less problems with settling out of the particulates. The tests in this final phase revealed higher wear rates than previously observed which may be due to downsizing and pointed to opportunity for improvements in the floating piston concept. For the particular sand-water slurry used certain problems were experienced with settling which doubtless was a factor in the high wear rates and caused valve problems and fairly rapid loss of discharge pressure. Vertical operation resulted in less wear than horizontal operation which may be due to settling of the solids in less sensitive places. It is concluded the floating piston concept has merit for handling hot abrasive slurries. The test results in this final phase were adversely affected by poor operation of the pump valves on the sand-water slurry. It is recommended that the design details be reviewed for improved operation. 14 figs., 5 tabs.

24057 (DOE/PC/70786—T12) **Transition metal catalysis of hydrogen shuttling in coal liquefaction: Final technical report, September 1, 1984 to September 1, 1987.** Eisch, J.J. (State Univ. of New York, Binghamton (USA). Dept. of Chemistry). 1987. Contract FG22-84PC70786. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004449/JAW.

The present research has investigated the catalytic activity of well-defined, soluble, low-valent transition-metal complexes in covalent bond cleavages reactions, which are typical of those taking place in coal liquefaction. The reactions include the rupture of C-C, C-H, C-S, C-N and C-O bonds. This study has shown that complexes of nickel(O) and cobalt(I) can cleave, and hence desulfurize, dibenzothiophene and related aryl sulfides below 100°C. Such a desulfurization procedure was also successfully applied to SRC liquids. Slower cleavages of certain C-N and C-O bonds could also be effected, but all such reactions proved to be stoichiometric, rather than catalytic. For a catalytic process, a step regenerating cobalt(I) or nickel(O) would have to be introduced. On the other hand, nickel(O) complexes were found to cleave C-H and certain C-C bonds in a catalytic manner. 37 refs., 4 tabs.

24058 (DOE/PC/70797—T9) **Fundamental approach to characterization and processing of coal-derived liquid (CDL): Final report.** Bunger, J.W.; Russell, C.P.; Horng, Jinp-Huei. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 10 Sep 1987. Contract FG22-84PC70797. 117p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88004079/JAW.

Adsorption of molecular species found on catalyst surfaces is a necessary condition for catalytic hydroprocessing of coal-derived liquids (CDL). The adsorption thermodynamics are a function of the molecular structure of the adsorbing species, surface structure of the catalyst, and the mobile phase composition. A quantitative understanding of the adsorption process may prove useful in understanding the reaction kinetics and kinetic inhibition generally observed when hydroprocessing CDL. A novel technique for rapidly measuring the equilibrium adsorption constant on a catalyst surface has been developed. The equilibrium adsorption constant can be determined at differing temperatures and the thermodynamic properties of the adsorption can be determined. The adsorption enthalpy and entropy of nearly 50 compounds were measured for the gas phase interaction with $Co\text{-}Mo/Al_2O_3$ hydrotreating catalyst. Results show that enthalpy, which is a measure of the electronic interaction, increases in negativity with increasing molecular weight, electron donating capability, aromaticity, and molecular polarity. For aromatic compounds, a good correlation is found between the enthalpy of adsorption and ionization potential. Entropy, which is a measure of geometric and spacial factors, was found to decrease (become more negative) with increasing molecular weight. Molecular symmetry also affects the entropy; the greater the symmetry, the more negative the entropy change. Empirical equations correlating the thermodynamic data with structural data have been developed. They have been used to predict the adsorption and possible catalytic process behavior of compounds which are present in CDL. 92 refs., 21 figs., 16 tabs.

24059 (DOE/PC/80502—T7) **Interactive chemistry of coal-petroleum processing: Quarterly progress report for June 16, 1987-September 15, 1987.** Curtis, C.W.; Guin, J.A.; Tarrer, A.R. (Auburn Univ., AL (USA). Dept. of Chemical Engineering). 1987. Contract FG22-85PC80502. 53p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE88003925/JAW.

The thermal and catalytic chemistry of napthalene, indan, indene, benzothiophene, o-cresol, benzofuran and quinoline has been investigated to help elucidate the reactions occurring during the coprocessing of coal and petroleum. Hydrogenation reactions were conducted. Three sets of reactions were performed: thermal, thermal with sulfur and catalytic with Mo naphthenate as an oil-soluble catalyst precursor and added sulfur to generate the catalyst in situ. A reaction temperature of 380°C and a hydrogen atmosphere of 1250 psig (cold) were used. Analysis of the solids generated from Mo naphthenate and sulfur amorphous and poorly crystalline molybdenum sulfide, most probably MoS_2; however, the exact stoichiometry is inknown. The thermal reaction was performed as a baseline and to evaluate the thermal interactions among the various hydrocarbon and heteroatomic species; the thermal reaction with sulfur was performed to ascertain the effect of excess sulfur on the system since the catalytic system required excess sulfur to form the in situ generated catalyst; and the catalytic reaction was performed to determine the interactive chemistry of the hydrocarbons and heteroatomic species under catalytic coprocessing conditions. 13 refs., 14 figs., 10 tabs.

24060 **(DOE/PC/80502—T8) Interactive chemistry of coal-petroleum processing: Quarterly progress report, September 15, 1987-December 15, 1987.** Curtis, C.W.; Guin, J.A.; Tarrer, A.R. (Auburn Univ., AL (USA). Dept. of Chemical Engineering). 1987. Contract FG22-85PC80502. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004541/JAW.

Some conversion and hydrogenation reactivity of benzofuran was observed in the thermal reaction with sulfur. However, catalytic reaction with Mo naphthenate was required for substantial, nearly 50%, hydrogenation, complete hydrogenolysis and high levels, ~80%, deoxygenation. The introduction of benzothiophene and o-cresol lowered both hydrogenation and deoxygenation while the addition of quinoline markedly reduced hydrogenation, virtually eliminated deoxygenation and slightly reduced hydrogenolysis. Quinoline, by contrast to all of the other compounds studied, produced substantial thermal hydrogenation to THQ; however, the introduction of both hydrocarbons and heteroatomics reduced the conversion of quinoline to THQ. The presence of the oxygen containing compounds nearly eliminated the conversion of quinoline to THQ. Similar results were observed in the thermal reactions with sulfur. Catalytically, quinoline was readily hydrogenated and denitrogenated. The addition of both hydrocarbons and heteroatomics had little influence on the quinoline reaction except for the introduction of benzothiophene at higher reactant levels. When added to a catalytic reaction of naphthalene and quinoline, the addition of benzothiophene reduced the catalyst poisoning effects of quinoline. The hydrogenation of naphthalene double while the hydrogenation, hydrogenolysis and denitrogenation of quinoline were all improved. 15 refs.

24061 **(DOE/PC/80526—T8) Chemical trapping of CO/H_2 surface species: Quarterly report.** Yusko, M. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Dec 1987. Contract FG22-85PC80526. 25p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006499/JAW.

Model organometallic complexes provide a useful analogy to metal catalyst surfaces. Their similarities to a supported metal, absorbate atoms, and metal-absorbate bonds allow comparison of surface chemistry studies. By probing the nature and mechanisms of intermediate surface chemistry species, catalyst activity and selectivity effects can be understood. Chemical trapping identifies surface species through the use of a trapping reagent, such as $(CH_3)_2SO_4$, which theoretically deposits an alkyl group onto the surface species at the species' previous place of attachment to the surface. Chemical trapping is here importantly extended to a model organometallic complex, namely, ethylidyne tricobalt enneacarbonyl, to enjoy the mechanism-hunting advantages from a well-defined metal-absorbate complex system. 8 refs., 4 figs., 3 tabs.

24062 **(OD—8101) Comparison of selected gasification processes.** (Onakawana Development Ltd. (Canada)). Jan 1981. 69p. (MICROLOG—82-0926). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The purpose of this study was to assess the economics and efficiency of converting the lignite into medium BTU gas (MBG) in a commercially available gasifier, and to establish the feasibility of generating electric power by means of an integrated combined cycle installation. Three commercial gasifier processes were examined together with three modes of power supply. The three gasification processes studied were Koppers-Totzek, Winkler, and Texaco. The three power supply options were no MBG converted to power, sufficient MBG converted to power to satisfy the plant and mine requirement, and all MBG converted to power. The results show that of the nine cases considered, the Winkler process combined with purchased power was the most economical method of operation.

0105 By-products

24063 (CONF-860294—, pp 85-94) **Isolation and identification of hopane derivatives, aliphatic and aromatic hydrocarbons from coal extracts and degradation products.** Kraemer, M.; Haedicke, A. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

Analyses of coal oil from tetralin decomposition and of the acetone extract have shown that these are highly complex mixtures. Still, a description of satisfactory quality is possible by pre-separation followed by gas chromatography and mass spectrometry. This description will serve as a basis for a comparison with the low-molecular substances from mild chemical degradation of the coal and coal derivatives.

0106 Properties

REFER ALSO TO CITATION(S) 24048, 24073, 24082

24064 **(CANMET—87) A continuing study of CWF fuels and atomizers with development of numerical analysis of atomization and spray formation and a statement on experimental research work required. 3 volumes. Final report.** Grossman, R. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). [1987]. vp. (MICROLOG—87-01221). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

As part of this work, performance improvement of the earlier coal-water fuel producers and atomizer designs was determined. A fundamental knowledge of fuel and atomizer characteristics that could yield an ability to predict quality or performance from the combination use of various fuels and atomizers was established. The data expressing the empirical relationship of viscosity to CWF characteristics was extracted. It was found that there was no correlation between fuel and atomizer design, and that atomizer design was a trial and error process of extrapolations from previous design and/or field results. It was concluded that a numerical analysis of CWF flow mode, viscosity and the atomizing function, be established to develop predictive equations for efficiency of burn-out. Further research needed is projected.

24065 (CONF-860294—, pp 17-31) **Determining the coalification status of coals of different character and different origins.** Wolf, M. (Technische Hochschule Aachen, Germany, F.R. Lehrstuhl fuer Geologie, Geochemie und Lagerstaetten des Erdoels und der Kohle). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The comparison of various methods suggests the following conclusions: 1. A combination of reflected and fluorescence measurement appears to be best suited for a fast characterisation of the coalification status. The fluorescence spectra of liptinites and vitrinites provide information on the coalification status, while the fluorescence intensity of the vitrinite also yields facial information.

24066 (CONF-860294—, pp 33-45) **Origin and significance of chemical fossils in sediments, crude oils and coals.** Albrecht, P. (Strasbourg-1 Univ., 67, France. Lab. de Chimie Organique des Substances Naturelles). 1986. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The main contribution to the geological organic matter which accumulates in the marine and terrestrial sedimentary basins of the world are microscopic algae, bacteria and higher plants. In the recent sediment stage geological organic matter is transformed

and reworked to a large extent by microorganisms. When the sediment is buried the microbiological activity is rapidly stopped. The sedimentary organic matter, however, undergoes further changes mainly under the increasing thermal stress. Many of these changes can now be followed with the help of chemical fossils, also called biological markers. Chemical fossils are molecules of biological origin which occur more or less degraded in geological organic matter. Their structures can yield useful informations on their origin, as well as on the transformations which they have undergone during their geological history.

24067 (CONF-860294—, pp 47-60) **Formation and conversion of phenanthrene and naphthalene derivatives in coals with a higher coalification status as a function of coalification.** Radke, M. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Erdoel und Organische Geochemie). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The investigation of the distribution of aromatic hydrocarbons in rock samples from a hole in the West Canadian Deep Basin had led to the development of a 'hydrocarbon-intrinsic' maturity parameter, i.e. the methyl phenanthrene index (MPI 1). These data were combined with data of another experiment in an attempt to 'calibrate' the parameter MPI 1 on the basis of vitrinite reflectance. Since then, a modified linear regression is commonly used for calculating vitrinite reflectance from MPI 1, especially in cases where reliable microscopic data are not available. The MPI 1 parameter has an accuracy around +- 0.06% (absolute) if coalification took place at 'normal' geothermal heating rates. The Ruhr coal samples investigated so far fulfilled this requirement.

24068 (DOE/PC/70783—T1) **Reactivity and nature of free radicals in catalytic coal oxidation: Final report, September 1, 1984-August 31, 1987.** Klier, K.; Simmons, G.W.; Herman, R.G.; Cole, D.A. (Lehigh Univ., Bethlehem, PA (USA)). Nov 1987. Contract FG22-84PC70783. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003209/JAW.

Pyrolytic and oxidative treatments of three coals, Illinois No. 6, Montour, and Adaville No. 1, have been performed between 349 and 583 K. Free radical concentrations were followed by electron spin resonance as a function of time of treatment at a given temperature. Initial increases in the organic free radical concentrations were observed at all temperatures, but at the higher temperatures termination reactions caused the increase to be transient. The decay of free radicals generated at 583 K in the Illinois No. 6 coal proceeded by a first order reaction, in contrast to the second order free radical decay under near-ambient conditions. With a low mineral-containing subbituminous Adaville No. 1 coal, the process of flowing air over the coal at low temperatures, 349-418 K, resulted in the generation of about twice as many free radicals as when the treatment gas was nitrogen. The mild oxidation of Montour coal by air in a fluidized-bed reactor has been studied by utilizing XRD, scanning electron microscopy accompanied by energy dispersive x-ray analysis, and Moessbauer spectroscopy. These techniques show that some of minerals in Montour undergo changes concurrently with the reactions of the coal matter. Oxidative transformations of iron minerals in a heavily weathered Illinois No. 6 coal were investigated by Moessbauer spectroscopy and x-ray powder diffraction (XRD). Temperature ranges were determined for the conversions of pyrite to ferrous sulfate and ferric hydroxysulfate and of ferric hydroxysulfate to ferric oxysulfate and ferric oxide. Most pronounced mineral transformations occurred at temperatures ≧563 K. This is the temperature range at which extensive weight loss of the organic coal matter began. 129 refs., 62 figs., 7 tabs.

24069 (RFP—4019) **The use of sulfuric/phosphoric acid treated peat for radioactive wastewater treatment.** Bynum, R.V.; Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1986. Contract AC04-76DP03533. 6p. (CONF-860411—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005142/JAW.

From 1. international conference on separations science and technology; New York, NY, USA (15 Apr 1986).

Peat is relatively inexpensive material which possesses a native cation exchange capacity. Efforts to utilize peat have been hampered by its low permeability to water and its tendency to severely leach in water at pH 6. These disadvantages have been significantly minimized by treating the peat with a combination of concentrated sulfuric and phosphoric acids, resulting in a particulate material which is permeable to water and resistant to leaching. The acid treatment also increases the cation exchange capacity of the peat. This paper describes the results of both column and batch studies of the modified peat for use as an actinide adsorbent. 1 ref., 2 figs.

0108 Waste Management

REFER ALSO TO CITATION(S) 24189, 24935

24070 (ADM—CC0473) **Saarberg-Hoelter FGD [flue gas desulfurization] process cost estimate. Final report.** (Acres Davy McKee Ltd., Toronto, Ontario (Canada)). 31 May 1981. 256p. (MICROLOG—82-1546). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Since the use of a calcium suspension as the washing fluid in conventional lime systems put restrictions on scrubber operation, a second-generation system was designed. Besides the added advantage of producing highgrade gypsum as a byproduct, the Saarberg-Hoelter process uses a clear alkaline solution as the washing fluid. This highly reactive scrubbing medium permits increased SO/sub 2/-removal levels. This process takes a completely different approach to control of scrubber pH. The key to the process is the controlled use of chlorides. The flue-gas train for the Davy S-H process encompasses three operational steps of absorption, oxidation, and separation. Although the process can handle large quantities of particulates, an electrostatic precipitator of bag-house is recommended upstream of the process to lower the particulate level. Because there is no slurry plugging, scaling and corrosion, problems are virtually eliminated along with the need for frequent cleaning. The gypsum produced as a byproduct may have a future sales potential as raw material for the wallboard and cement industries.

24071 (DOE/ID—12112) **Availability of trace elements in solid waste from fluidized bed combustion of coal.** Rope, S.K.; Jornitz, R.S.; Suhre, D.T. (USDOE Idaho Operations Office, Idaho Falls. Radiological and Environmental Sciences Lab.). Dec 1987. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006725/JAW.

This report presents data on the inorganic constituents (major and trace elements) of coal and solid waste from a coal-fired facility on the Idaho National Engineering Laboratory (INEL) which uses the fluidized bed combustion process. Three factors were used to assess the potential environmental impacts of elements in coal waste: (1) the concentrations relative to those measured previously in surrounding soils of the INEL (the enrichment ratio); (2) the availability of elements from waste relative to soils; and (3) toxicity or essentiality to biota. Considering both enrichment and availability, Al, B, Be, Ca, Cr, Na, Mo, Se, Sr, and Ti are most likely to be affected in the local environment due to fly ash deposition and/or resuspension of FBC waste. Only B, Cr, Mo, and Se are likely to be of concern in terms of toxicity. The high concentrations of Cr and B in FBC waste are expected to be toxic to plants. Concentrations of Se and Mo present in FBC waste have been shown to produce levels in plants which can be toxic to herbivorous animals. 14 refs, 1 fig., 4 tabs.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 24049, 24078

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 24065, 24066, 24067

24072 **(COAL/GE—5/R-44/Add.3) Study and geological methods of assessing coal deposits.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 30 Nov 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88900386/JAW.

General and detailed prospection studies are undertaken in order to determine the presence of lignite. To determine the distribution and characteristics of the deposit, the presence of which is already established, detailed geological studies and geophysical surface studies (generally, electrical resistivity) are undertaken to decide the form and scope of future work. Test pits and drilling are undertaken to determine the coal reserve in the deposit. In the laboratories various analyses of the collected samples are made. The feasibility studies start at this stage and are continued. The thickness of the sediments is determined by geophysical measurement. These measurements are helpful in selecting the locations of exploration drilling wells. The basic principles in the planning of exploration drillings are: drillings are made by moving from known to unknown; the distances between drilling wells are approximately 800 to 1000 m. But, drillings to establish reserves, depending on thickness, depth, continuity and quality of the coal seams are undertaken at intervals of 150 to 200 m to 300 to 400 m. In several of the exploration wells, generally, advance with core recovery is at 70%. However, in the wells in between and in drilling to establish reserves, advance down through the coal zone is always carried out with core recovery. At other levels, the amount of core is kept at the minimum possible level. Because of the small and irregular nature of the lignite deposits in Turkey, advance by drilling wells only with cuttings is not adopted. In order to recognize the lithology one or more drillings are made wth full core recovery in each basin.

24073 **(CONF-860294—) Geochemistry, coalification and gas formation in deep coal strata.** (Studiengesellschaft Kohlegewinnung Zweite Generation e.V., Essen (Germany, F.R.)). 1986. 203p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The seminar comprises the sections: Origins, reaction and identification of chemofossils in organic sediments and their dependence on coalification (9 papers) and modelling of geochemical and in-situ reactions (4 papers). Separate records are available for all papers.

24074 (CONF-860294—, pp 113-136) **Isotope measurements for characterizing organic sediments and assessing their maturity and coalification status.** Stahl, W.J. (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The isotope geochemistry of carburetted hydrogen gases provides a basis for subsurface assessment of the maturity and type of hydrocarbons-forming mother substances in deep strata, if possible also deep coal strata.

24075 (CONF-860294—, pp 141-158) **Three-dimensional integrated basin modeling - a logical continuation of current exploration concepts. The conceptual model, its calibration and testing.** Welte, D.H.; Yalcin, M.N.; Yuekler, M.A. (IES Gesellschaft fuer Integrierte Explorationssysteme m.b.H., Juelich, Germany, F.R.). 1986. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The input data for the computer simulation is deduced from the constraints and boundary conditions of the conceptual model. The input is stored in the form of maps in a strict time sequential order in a 3-dimensional grid system. These data are used later when solving equations for water flow, heat transfer, maturity, hydrocarbon yield determination etc. Information from so-called key wells, which should be representative for the geologic evolution of a certain part of the basin, is used to test and calibrate the conceptual model against actual data. During these one-dimensional simulation test runs of key wells, important parameters, calculated and measured are compared and matched by special iteration techniques.

24076 (CONF-860294—, pp 193-206) **Influence of the geothermal gradient on coalification calculations using a reaction kinetics model.** Klein, J.; Loecken, K. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The reaction kinetics during the geochemical phase of metamorphosis can be described in analogy to the pyrolysis process. The functional interdependence between the temperature and the maximum gas formation in the pyrolysis process has been proved for heating rates of m = 10/sup -3/ to 10/sup 4/ K/min. Extrapolation to heating rates of 10/sup -11/ K/min appears to be acceptable.

0120 Mining

REFER ALSO TO CITATION(S) 24049, 24857

24077 **(COAL/GE—5/R-37/Add.9) Water management and protection in opencast mining regions and utilization of mine water.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 12 Nov 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88900395/JAW.

Opencast pits are dewatered exclusively through gravity drainage, the predominant technique being the use of dewatering boreholes. Support is basically assured by the material inserted in the excavations (ceramic pipes, cement filter pipes, gravel filters). The perforated and solid-wall pipes used in the boreholes have an internal diameter of 350 mm. There is only limited use of metal piping to support dewatering boreholes and it is confined to those areas of pits that are free from mining activity. The water raised to the surface by means of submersible pumps with submersible motors is directed into a collector (pressure or non-pressure pipeline, drainage ditch) and carried to a groundwater treatment plant or directly to the drainage system or to a user (for example, to a waterworks). Mine water is purified: in artificial lakes; and in mine-water treatment plants. The water is mechanically purified and neutralized through the addition of lime and the precipitation of the iron in the form of iron hydroxide sludge. Approximately 60% of all mine water is purified; 40% of such water is of sufficient quality to be discharged without treatment. The quality characteristics of purified mine water correspond to the figures. Generally speaking, the purified mine water improves the quality of the water in receivers. The amount of mine water used represents 39% of the total. It is supplied in the form of raw water and the receiving Kombinat is responsible for upgrading it for industrial or human consumption (for its own needs or for the supply of drinking water to the public).

24078 **(COAL/GE—5/R-39/Add.4) Techniques for the restoration and rehabilitation of opencast workings.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 3 Dec 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88900385/JAW.

During the planning stage of the mine, the necessary soil surveys are carried out to quantify the soil resources and to determine their characteristics. During the operation of the mine some additional soil surveys are also carried out. A reclamation plan is

prepared for that purpose. Some revisions related to the actual mining conditions are carried out during the operation of the mine. The top soil, loess and the other type of potential soil-making materials are stripped by the bucket wheel excavators separately and spread by stackers on top of the dumps. They are not stored alongside separately. The storage height of soil mounds are calculated before commencement of operations by geomechanical methods. The spreading equipment used does not cause any severe compaction. However, the surface of the dumping area is ripped and ploughed occasionally. The soil is spread by stackers and then graded by bulldozers. The restored final land form, gradients and surface water drainage systems are designed before opencast operations commence. All activities are implemented according to the design specifications. The restoration works are handled with special care. The rehabilitation methods used to return opencast land to forestry are described briefly.

24079 **(COAL/GE—5/R-40/Add.2) Improvement of blasting techniques in opencast mines.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 25 Nov 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900394/JAW.

Experience to date indicates that the most important factors affecting the degree of blasting required are the homogeneity of the hard rocks and their overall thickness taken together with the amount of regional jointing, stratification fractures and induced fracturing. Blasting operations in opencast mines, where the overburden consists of hard sandstone bands, mudstones and siltstones are continuous, in that they take place progressively on each seam bench and overburden parting between coal seams, the latter are not blasted. Blasting operations are restricted to the hours of daylight. The blasting geometry, burden and spacing will depend upon the degree of fragmentation required, depth of overburden parting, type of excavator and bucket capacity, required blasting ratio, cubic metres of overburden/weight of explosive charge (M^3/Kg), blast hole diameter and explosive charge weight. Blast-hole geometry, burden and spacing can vary from a 3 metre x 3 metre square pattern to a 6 metre x 6 metre square pattern. In certain site blasting conditions a rectangular blast-hole pattern may be used. Blasted overburden is excavated by either dragline, rope or hydraulic face-shovels, hydraulic backactor or front-end loading shovel. The material excavated by face-shovel, backactor etc., is hauled either to spoil dumps or to progressive backfill of decoaled areas. The types of excavators in use in opencast mines in the United Kingdom are summarized. In-pit crushing of overburden with associated conveyor belt systems is not employed in opencast mines owing to the nature of the mining operations and the complexity of multi-seam mining. The use of explosives in quarries is controlled by the Quarries (Explosives) Regulations 1959 (Statutory Instrument 1959 No. 2259).

24080 **(ECE-COAL—113) Eighty-third session [of the] Coal Committee report.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 13 Nov 1987. 24p. (CONF-8709244—Summ.). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900393/JAW.

From 83. Economic Commission for Europe Coal Committee session; Geneva, Switzerland (28 Sep 1987).

The eighty-third session of the Coal Committee was held from 28 September to 1 October 1987. The following countries were represented at the session: Belgium; Bulgaria; Czechoslovakia; Finland; France; German Democratic Reupulic, Germany, Federal Republic of; Hungary; Italy; Netherlands; Poland; Portugal; Spain; Switzerland; Turkey; Ukrainian Soviet Socialist Repulbic; Union of Soviet Socialist Republics; United Kingdom; United States of America; and Yugoslavia. Australia and Japan participated under article 11 of the Commission's terms of reference. Representatives of the following specialized agencies and other intergovernmental organizations were in attendance: United Nations Conference on Trade and Development (UNCTAD); Council for Mutual Economic Assistance (CMEA); European Economic Community (EEC) and International Labour Organisation (ILO). The provisional agenda (ECE/COAL/112) was adopted. The results of certain working groups are discussed very briefly.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 24050

24081 **(EPRI-AP—5628) Erosion-corrosion of materials in coal-water slurries: Final report.** Levy, A.V.; MacAdam, S. (Lawrence Berkeley Lab., CA (USA)). Feb 1988. Contract AC03-76SF00098. 58p. NTIS, PC A04/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. Order Number DE88006195/JAW.

A coal-water, erosion-corrosion, laboratory test project was carried out to determine the comparative material wastage rates of several types of candidate materials for service on the internal walls of the slurry transfer lines of a coal gasifier. The primary governing factor in their performance was their corrosion resistance in both neutral and somewhat acidic slurries; hardness was decidedly a secondary factor. The lowest wastage rate materials were the ceramics with basalt probably being the best overall material tested from a combined performance and cost consideration. The higher chromium steels, which had reasonable corrosion resistance, had somewhat higher but still acceptable wastage rates. The mild steel and surface hardened, low chromium containing alloy steels had similar and quite high material wastage rates, as did a neoprene rubber which was also tested. 3 refs., 21 figs., 7 tabs.

0140 Combustion

REFER ALSO TO CITATION(S) 24048, 24106, 24266, 24274, 24934, 24935

24082 **A laboratory study of the dynamics of explosive boiling of coal-water fuels.** Maloney, D.J.; Spann, J.F. (U.S. Dept. of Energy, Morgantown Energy Technology Center, P.O. Box 880, Morgantown, WV 26507-0880). pp 1 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Agglomeration of coal particles during combustion of atomized Coal-Water Fuels (CWF) droplets can limit efficiency. However, if enough radiation energy is incident on the droplet more complete disruption of the particles may occur via explosive boiling. This is possible because radiation penetrates the relatively transparent water and is absorbed by the opaque coal particles. Water at the coal-water interface is then heated, and upon reaching some critical temperature, bubble nucleation occurs. The rapid growth of such vapor bubbles can result in the explosive fragmentation of the droplet. The radiant energy flux required to achieve explosive boiling as a function of droplet size and coal loading has been measured. Single CWF droplets were electrodynamically suspended and irradiated on opposite sides using a Nd:YAg laser with pulse lengths of 0.2ms to 8.0ms and intensities ranging from 10e2W/cm2 to 10e4W/cm2. The interaction of the droplet and the laser beam was recorded with high speed cinematography. The dynamics of the droplet behavior will be discussed. The authors find evidence of rapid heating just below the droplet surface giving rise to the growth of a radially expanding vapor bubble followed by the explosive breakup of the droplet core.

24083 **Dynamic response of fluidized beds.** Beasley, D. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-870816—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Technical Paper 87-HT-41.

The purpose of this study is to quantify the transient response of a fluidized bed combustor to changes in the operating variables and to develop a semi-empirical predictive scheme for describing the response of a particular bed. Transient measurements of the bed temperature following a step change in process variables have been made for a 2 ft. by 4.8 ft. combusting bed using coal as

the fuel. The response characteristics are described by a classical first-order system response model and allow prediction of the dynamic temperature characteristics of combusting beds from the fundamental physical parameters, such as air and fuel rates, and the mass of material contained in the bed. The results of this study indicate that a fluidized bed process heater may respond adequately to changes in load demand with appropriate control strategies.

0150 Marketing And Economics

24084 **(DOE/EIA—0121(87/3Q)) Quarterly coal report, July-September 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 23 Feb 1988. 142p. NTIS, PC A07/MF A01 - GPO; 1; GPO Dep. Order Number DE88006947/JAW.

This report provides comprehensive information about coal production, exports, imports, receipts, consumption, and stocks in the United States to a wide audience, including Congress, Federal and State agencies, the coal industry, and the general public. This issue shows detailed quarterly data for July through September 1987, aggregated quarterly historical and projected data for 1980 through 1988, and aggregated annual historical and projected data for 1960 through 2000. Appendix C shows detailed quarterly historical data since 1980 on coal imports. Appendix D presents selected quarterly tables converted to metric ions. The historical data in this report are collected by the EIA using three quarterly coal surveys (coal consumption at manufacturing plants, coal distribution, and coal consumption at coke plants) and two monthly surveys of electric utilities. In addition, data from the annual survey of coal mining operations appear in Appendix B.

0160 Health And Safety

REFER ALSO TO CITATION(S) 24071

02 PETROLEUM

24085 **(SEMR—87) Annual report, 1985-1986, Saskatchewan Energy and Mines for the fiscal year ending March 31, 1986.** (Saskatchewan Dept. of Energy and Mines, Regina (Canada)). 1987. 38p. (MICROLOG—87-05918). Saskatchewan Energy and Mines, 1914 Hamilton St., Regina, Sask., Canada S4P 4V4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The governments of Canada, Saskatchewan, Alberta and British Columbia made new developments exempt from the Petroleum and Gas Revenue Tax but left them eligible for grants through the Petroleum Incentive Program until March 31, 1986. In June, 1985 Saskatchewan extended its oil royalty/tax incentive program until the end of 1986. The latter part of the fiscal year brought a dramatic 60% drop in world crude oil prices. The province, in consultation with the oil industry, developed a temporary program to help maintain oilfield employment during unstable prices. Over $1 billion was spent by oil and gas companies on exploration and development. Oil production increased by 7.2% in 1985 over previous year. Land sales revenue totalled $122.8 million. A natural gas policy announced July, 1985 was designed to help achieve the goal of self sufficiency in gas production by early 1990s. Export gas and direct sales to new industrial projects, are permitted under the policy. As well, the policy restructures the regulated pricing system for gas produced from new wells. Further changes were made when the governments of Canada, Saskatchewan, Alberta and British Columbia signed the Agreement to Deregulate Interprovincial Gas Markets on October 31, 1985. Natural gas drilling activity remained strong in 1985 with 437 wells drilled. Saskatchewan's long term objective to develop its heavy oil resource was achieved in part with the confirmation of a 50,000 barrel per day heavy oil upgrader. Important research in heavy oil development continued under the Heavy Oil/Fossil Fuels Research Program. 16 figs.

0201 Reserves

REFER ALSO TO CITATION(S) 24097

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 24073, 24074, 24075

24086 (CONF-860294—, pp 61-74) **Interdependences between chemofossils conversion in the organic material of sediments and the coalification rate.** Rullkoetter, J. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Erdoel und Organische Geochemie). 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770090/JAW.

From Seminar on geochemistry, coalification and gas evolution in deep coal strats; Aachen, F.R. Germany (27 Feb 1986).

The investigation of the temperature- and time-dependent variations in the chemofossils composition in the organic material of the sediments is a central field of molecular organic chemistry. A status report on this field is presented using the example of saturated and aromatic steroid hydrocarbons. Owing to the fact that the kinetics of the geochemical reactions differs greatly, it is impossible to establish a simple, generally valid relationship between chemofossil conversion on the one hand and a coalification parameter like the vitrinite reflectance on the other hand. The geochemical behaviour of chemofossils in coal is still hardly explored.

24087 **Effect of hydrodynamic dispersion on heat transport in the porous Benard problem.** Georgiadis, J.G.; Catton, I. (Mechanical/Aero/Nuclear Engineering Dept., Univ. of California at Los Angeles, Los Angeles, CA (USA)). pp 57-64 of Heat transfer in geophysical and geothermal systems. Vafai, K.; Prasad, V.; Catton, I. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870816—).

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

A numerical and experimental study is reported for the case of buoyancy-driven convection in saturated horizontal packed beds. The classical Darcy model is extended by the Forchheimer (inertial) term and the effective thermal conductivity of the medium is represented by the sum of a stagnant and a (hydrodynamic) dispersive component, the latter being proportional to the local velocity amplitude. Although both effects are important, the dispersive effect dominates. The ratio of layer thickness to bead diameter is proven to be a significant parameter of the problem that can help to explain the observed Nusselt number data divergence in shallow porous layers.

0203 Drilling And Production

24088 **(CHMH—AC15671/AO) Generation of steam using low-grade fuels and field produced water for in-situ oil recovery. Final report.** (CH2M Hill Canada Ltd., Calgary, Alberta). Aug 1982. 201p. (MICROLOG—83-2114). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objectives were to assess the nature of field-produced or recycle water from thermal recovery operations in western Canada, to report on the status of technology for the generation of steam for oil field injection using solid fuels and/or field-produced water with minimal pretreatment, to assess the potential for application of these technologies to thermal recovery of oil in western Canada (specifically wet oxidation and Thermosludge steam generation), and to assess the feasibility and advantages of directly injecting steam and combustion gases into the oil-bearing formation. Phase 1 involved the development of a data base and identification of steam generation technologies which fulfilled the criteria for further evaluation, while Phase 2 entailed the detailed technology review. 14 figs., 3 tabs.

24089 **(ERCB—871026) Shell Canada Limited well licence applications Waterton/Prairie Bluff Area.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 26 Oct 1987. 24p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

The Energy Resources Conservation Board received applications from Shell Canada Limited February 13, 1987 for licences to drill two wells in Waterton/Pincher Creek area. The proposed wells would be directionally drilled and designated as critical sour gas wells. As a result of continuing concerns over environmental issues, a hearing was convened August, 1987. Having considered the evidence, the Board believed the issues to be the need for and proposed locations of the wells, including potential alternatives. Potential environmental impacts and mitigative measures to reduce them were also considered. The views of the applicant, interveners, and the Board are presented. The Board concluded that there was a need for the wells and no practical alternatives could be identified. The belief was that the development could proceed without long-term impact and the Board was prepared to issue the necessary licences. 2 figs.

24090 **(ERCB/C—D/87/7) Dome Petroleum Limited, Petro-Canada Inc., Amoco Canada Petroleum Company Ltd: gas cycling applications. Brazeau River Nisku P Pool.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 10 Apr 1987. 14p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Dome Petroleum Limited filed in July 1986 for approval of a full voidage replacement gas cycling scheme. Between July and October 1986, Dome filed for construction of gas injection facilities. In October Amoco Canada Petroleum Company Ltd. filed for a review of the facilities applications. A combined hearing was scheduled for January 1987 to consider the Dome cycling application and the counter-application by Amoco. A public hearing was held March 1987 where the views of the applicant and intervenors were discussed. The Energy Resources Conservation Board was to decide if the net advantages of a single pool-wide scheme outweighed the net advantages of competitive schemes. The Board decided to grant approval to the applicants for three cycling schemes (Dome, Amoco, and Petro-Canada) subject to the conditions of full voidage replacement, reservoir pressures at a minimum of 28,800 kPa, and that all scheme performance information and operating forecasts be made available to operators of other schemes in the pool. 3 figs.

24091 **(NP—8770081) Properties of microemulsions of non-ionic tensides and investigation of mixtures of non-ionic and anionic tensides for enhanced petroleum recovery.** Gade, B. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 26 Feb 1986. 193p. (In German). NTIS (US Sales Only), PC A09. Order Number DE88770081/JAW.

Middle phases can be obtained in a wide range of temperatures and salinities without using alcohols by means of non-ionic tensides and mixtures of non-ionic tensides and pretroleum sulfates. The middle phases contain most of the tensides; they are salt-depleted and show enrichment and depletion trends of alkanes, aromatic hydrocarbons, and colloidal oil constituents as compared with the oil phases. The rheological characteristics of the aqueous solutions of the non-ionic tensides show that the hydration state of the ethylene oxide chain changes with the temperature. The hydration behaviour of the tenside molecules also influences the rheological behaviour of the middle phases produced with non-ionic tensides, although the water separation from the ethylene oxide chains of the tensides in the middle phases is connected with a phase inversion from water-external to oil-external. The structural changes in the middle phases resulting from temperature changes may be determined by viscosity measurements, refraction index measurements, surface tension measurements, and electric conductivity measurements. In the tenside mixture, there is a linear dependence between the phase inversion temperature and the petroleum sulfonate concentration at constant concentration of the non-ionic tensides, so that mixtures of these tensides at 10/sup 0/C to 70/sup 0/C will result in middle phases with salinities between 5.6% and 14%.

24092 **(SEMR—87) Supplementary well information and production history of producing and non-producing wells near Crown P. & N.G. leases and drilling reservations offered at the land sale on June 9, 1987. 3 volumes.** (Saskatchewan Dept. of Energy and Mines, Regina (Canada)). 1987. 719p. (MICROLOG—87-05433). Saskatchewan Energy and Mines, 1914 Hamilton St., Regina, Sask., Canada S4P 4V4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Statistical data only are provided in tabular form for producing and non-producing wells in Saskatchewan located on Crown leases and drilling reservations. No text is included.

0204 Processing

REFER ALSO TO CITATION(S) 24059

24093 **(PCPP/RD—87) Primary thermal upgrading of residua to transportation fuels. Final report.** Chmielowiec, J.; Whitelegg, N. (Petro-Canada Products, Sheridan Park, Ontario. Research and Development Centre). 1987. 52p. (MICROLOG—87-04536). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Interprovincial Pipeline crude, Lloydminster heavy oil and Athabsca bitumen were thermally upgraded at high temperatures in the absence of external hydrogen. Both the bench scale and microscale tests were performed. Effects of processing conditions, steam injection and addition of solid substrates on the yield and quality of the products were evaluated. The bench tests employing either steam injection or solid substrates as well as microscale tests were carried out at 510/sup 0/C. The solid additives comprised iron ore, sand vanadate slag and metalloporphines. In general, it was found that the microscale test was more efficient than the bench scale test for monitoring of the product yields. The differences in coke and liquid product characteristics are reported. The mass spectrometric analyses revealed the superiority of gas oil while coke of the same origin, characterized by thermogravimetric analyses, was better quality. 7 figs., 19 tabs.

24094 **(SBRG—8107) Chemical characterization of pitch. Final report.** (Sandwell Beak Research Group, Toronto, Ontario (Canada)). Jul 1981. 44p. (MICROLOG—82-1543). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This project is a study on the upgrading of residual oil fractions into low sulphur distillates and fuel oils and also deals with economic uses for these products. The classic methods of handling low grade residuals, coking, visbreaking and delayed-coking, are alternatives becoming less attractive. New processes are being developed such as hydrocracking, flexicoking, coprocessing (which involves catalysts) and/or severe hydrogenation. The chemical properties of the pitch dictate the behaviour of this fraction during upgrading in terms of yields and quality of products as well as operational problems (coke formation, catalyst poisoning, severity of treatment). Viscosity, solubility and filtration characteristics depend almost exclusively upon the heteroatoms and types of hydrogen bonding within the molecule. The type of reactor and/or fractionation procedure after upgrading are influenced by the chemical composition of the feedstock. Pumping and combustion characteristics of the final products are connected to fluidity, low sulphur and nitrogen emissions, and absence of trace metals. Hydrogen consumption is significantly higher for larger polar molecules and increases with the oxygen content. The study provides a comparison of chemical characteristics of three pitch samples obtained from bitumen and heavy oil distillations.

24095 **(UCRL—97248-Pt.2-Rev.1) Effect of prehydrogenation on hydroconversion of Maya residuum: Part 2, Hydrogen incorporation.** Beret, S.; Reynolds, J.G. (Chevron Research Co., Richmond, CA (USA); Lawrence Livermore National Lab., CA (USA)). 19 Jan 1988. Contract W-7405-ENG-48. 35p. (CONF-880348—3-Pt.2-Rev.1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006241/JAW.

From American Institute of Chemical Engineers spring national meeting; New Orleans, LA, USA (6 Mar 1988).

Maya 650°F residuum (Maya AR) was prehydrogenated over a standard hydroprocessing catalyst. The 650°F residuum of this product (HMaya AR) and Maya AR were then separately hydroprocessed further at selected conditions. The products were examined by elemental, ^{1}H, and ^{13}C NMR analyses. For all processing steps, hydrogen was incorporated in capping fragments formed during cracking reactions, as well as in hydrogenation reactions, heteroatom removal, and hydrocarbon gas formation, but the distribution of the hydrogen was dependent upon the type and severity of the process. For the direct hydroconversion of Maya AR, 25 to 30% of the total hydrogen was incorporated for heteroatom removal and hydrocarbon gas formation. The remaining hydrogen was incorporated in hydrogenation and cracking reactions. For the two-step hydroconversion process, 30 to 40% of the total hydrogen was incorporated for heteroatom removal and hydrocarbon gas formation. The remaining was primarily incorporated in hydrogenation reactions. Some was incorporated into cracking reactions in the moderate severity case, but none was seen in the low severity case. The hydrogen incorporation during each specific processing step is discussed, along with an evaluation of the prehydrogenation step as a residuum conversion process option. These results will be also compared to previously reported hydrogen incorporation measurements on other feeds and processing methods. 8 figs., 8 tabs.

0205 Products And By-products

24096 **(T/MRL—85) Entrained bed gasification of residues using the Texaco Gasification Process.** (Texaco, Inc., Montebello, CA (USA). Montebello Research Lab.). 1985. 10p. (MICROLOG—87-02215). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report covers the results from a series of laboratory tests conducted on samples of Suncor coke, thermally hydrocracked pitch, and Syncrude coke. The purpose of the tests was to make a preliminary determination regarding the suitablility of these materials as feedstocks for the Texaco Gasification Process. The Texaco Gasification Process is the leading technology commercially available for use on solid carbonaceous feedstocks. The Suncor coke and Syncrude coke samples are good candidate feedstocks for the process. Both samples slurry well, have high heating values, and would be expected to produce a high product gas yield. Because of the observed slurrying characteristics, further evaluation appears to be required on the thermally hydrocracked pitch before commercial grinding/slurry preparation techniques could be considered sufficient. With the major exception of its slurrying characteristics, the thermally hydrocracked pitch would also appear to be a good candidate feedstock. 8 tabs.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 25022

24097 **(DOE/FE—0097) Environmental assessment: EA-0334 divestiture of Naval Petroleum Reserves Nos. 1 and 3.** (USDOE Assistant Secretary for Resource Applications, Washington, DC. Office of Naval Petroleum and Oil Shale Reserves). Feb 1988. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006693/JAW.

As part of an effort to increase revenues to the federal government, the Administration is proposing to sell the government's ownership interest in Naval Petroleum Reserves 1 and 3. Funds from the sale will be used to complete the filling of the Strategic Petroleum Reserve (SPR), and to establish a Defense Petroleum Inventory (DPI) of 10 million barrels of petroleum products which will be stored in the SPR to meet the petroleum requirements of the Department of Defense. Based on petroleum engineering and economic factors, it is anticipated that a private owner would substantially follow DOE's present Long Range Plan for the operation of NPR-1 over the next 7 to 10 years. If so, sale of the Reserve would not cause any changes in impacts on the geological resources, acoustic conditions, cultural resources and land use at NPR-1. There may be some changes to the impacts on biological resources, air quality, water quality and waste management practices caused by the change in ownership of the Reserve. However, a variety of regulatory factors make it likely that any changes in impacts between federal and private operation of the Reserve should be minimal. 42 refs., 6 figs., 10 tabs.

24098 **(NPD—87) Oil self-sufficiency and security of supply: the case for Hibernia: a position paper written in preparation for the Federal/Provincial Conference of Energy Ministers...** (Newfoundland Petroleum Directorate, St. John's (Canada)). 1987. 10p. (MICROLOG—87-06010). Petroleum Directorate, Government of Newfoundland and Labrador, St. John's, Nfld., Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Oil self-sufficiency and security of supply has long been a mainstay of Canada's energy policy. Canada is now self-sufficient in light oil for the first time since 1974. Over the same time period, Canada was able to increase its production of light crude oil. This demonstrates that even with price controls that kept Canadian prices substantially below international levels, commitment to the self-sufficiency and security of supply objectives enabled Canada to overcome massive demand increases. The ability to recognize importance of oil security and self-sufficiency ensured that domestic supplies were able to increase at an even more rapid pace than demand. This report addresses the need for self-sufficiency and security of supply in light crude oil and equivalants, and highlights the potential balance of payments costs through increased imports. Recently, there has come to the fore a movement advocating self-sufficientcy in 'total energy' as opposed to oil self-sufficiency. Throughout Canada, and internationally, there is a growing awareness of the need for policies directed toward ensuring a secure oil supply, both now and in future.

24099 **(NPD—0130A/3298A) Oilfield developments in the Newfoundland offshore, beyond Hibernia: a position paper written in preparation for the Federal/Provincial Conference of Energy Ministers ...** (Newfoundland Petroleum Directorate, St. John's (Canada)). 1987. 10p. (MICROLOG—87-06009). Petroleum Directorate, Government of Newfoundland and Labrador, St. John's, Nfld., Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Over one billion barrels of recoverable light crude oil is likely contained in eight discoveries outside the Hibernia discovery area. An additional eight billion barrels is thought to exist in other areas of the Newfoundland offshore. Combined potential is ten billion barrels, representing opportunity to offset light crude oil shortages predicted for the mid 1990's. Focus is being centered on preparing these areas for a productive contribution as a future secure source of supply. Studies indicate the supply cost of producing oil from the smaller light discoveries is competitive in Canadian frontier development. Further delineation drilling is required before the opportunities can be realized. Hibernia and its satellite fields can make substantial contributions to self-sufficiency. Investments in floating production technology will provide economic, employment, and industrial benefits to Newfoundland and other areas of Canada.

24100 **(PMA—870706) Canadian petroleum industry: 1986 monitoring survey.** (Petroleum Monitoring Agency, Ottawa, Ontario (Canada)). Jul 1987. vp. (MICROLOG—87-05073). Canada. Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report describes the financial performance of the oil and gas industry during 1986. The major factor responsible for the overall decline in the petroleum industry's financial performance was the sharp fall in crude oil prices. This led to large asset write-downs which should increase profits in future years by lowering charges for depletion and depreciation. Natural gas in 1987 is still affected by price and export market deterioration. Highlighted in the survey are financial performance, sources and uses of funds, comparative performance between petroleum and other industries, revenue sharing between industry and government, trends in ownership and control, and an operating summary for 1982-1986 with trends discussed. A new Canadian Institute of Chartered Accountants guideline summary is included for full cost accounting for upstream operations. 15 tabs.

0208 Waste Management

REFER ALSO TO CITATION(S) 24094

24101 **(OE—8707) The effluent monitoring regulation for the petroleum refining sector. Draft.** (Ontario Ministry of the Environment, Toronto (Canada)). Jul 1987. 109p. (MICROLOG—87-05117). Ontario Government Publications, Publications Services, 880 Bay Street, 5th. Floor, Toronto, Ont., Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document provides a draft of a Regulation made under Ontario's Environmental Protection Act. The draft Regulation is organized into the sections of definitions, application, characterization, routine monitoring, toxicity, testing, flow measurements, sampling requirements, analytical requirements and reporting. Schedules are attached to the Regulation identifying sampling frequencies, sampling principles and analytical principles. Appendix A provides information relating Ontario's Effluent Monitoring Priority Pollutant List to the chemical parameters in the Regulation. Appendix B describes flow measurement methods and devices. The MISA Advisory Committee Report on the Effluent Monitoring Regulation for the Petroleum Refining Sector is included. The report makes recommendations regarding the draft regulation. A section is provided with the summary of recommendations from the MISA Advisory Committee on the Draft Regulation, and the responses by the Ministry and/or the sectoral Joint Technical Committee.

24102 **(TCWG—8707) Environmental contaminants in petroleum refinery wastewaters: an assessment of current information and a monitoring approach.** (Trace Contaminants Working Group, Ontario (Canada)). Jul 1987. 43p. (MICROLOG—87-05119). Ontario Government Publications, Publications Services, 880 Bay Street, 5th. Floor, Toronto, Ont., Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report summarizes the findings of an Industry-Government Trace Contaminants Working Group that was assigned the task of reviewing the existing information on trace contaminants in treated oil refinery wastewaters. The technical committee reviewed a conceptual draft of the Ministry of the Environment monitoring and Reporting Regulation and required the findings of this report as a basis for their review. The available evidence indicates that under good operating conditions the treated effluent from Ontario petroleum refineries contain only a few trace contaminants, and their concentrations are consistently less than 50 parts per billion. Such levels reflect over 99.9% removal of the contaminants entering the treatment system.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 24089, 24101, 24102, 24112, 24538, 25077, 25097

24103 **(EPS—EE/81) A study of the fundamental mechanism of chemical dispersion of oil spills.** Chau, A.; Sproule, J.; Mackay, D. (Environnement Canada, Ottawa, Ontario. Conservation et Protection). May 1987. 22p. (MICROLOG—87-05082). Environmental Protection Directorate, Environment Canada, 351 St. Joseph Blvd., Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report is of a research program to elucidate the fundamental mechanism by which commercially available chemical dispersants cause the dispersion or emulsification of spills of crude oils on ocean surfaces. The program consisted of two approaches. First was an examination by eye, by still photography, by conventional video photography, and by high speed video photography of the microscopic despersion process which occurs when a drop of dispersant lands on an oil slick and induces dispersion. The study showed that the process is sufficiently slow. Some examples are given showing the dispersion event which appears to consist of a "burst" of oil emulsifying into the water column as a cloud of vaiable-sized oil droplets. Second was a study of the amount of oil dispersed as a result of placement of drops of dispersant of known size and number on an oil slick. To accomplish this a novel method of generating small dispersant drops was devised. The results tended to confirm earlier postulations that dispersion is a two regime process. First is a performance limited regime in which one volume of dipersant is able to disperse a fixed number of volumes of oil. Second in the case of thinner slicks is a less effective first order or access-limited regime in which one volume of dispersant is able to disperse only a fixed fraction of the remaining oil, (eg. 50%). The implications of these findings for countermeasures, research and emergency planning are discussed.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 24089

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 24875

0230 Properties

REFER ALSO TO CITATION(S) 24066, 24094, 24714, 24730

24104 **(NIPER—316) Influence of fuel aromatic content on exhaust emission: Final report.** Seizinger, D.E. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Dec 1987. Contract FC22-83FE60149. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006574/JAW.

Vehicles operated using fuels of higher aromaticity derived from heavier crude stocks will result in exhaust emission profiles different than those resulting from current fuels. To assess the effect of higher aromatics on emissions, a test program was developed to measure Federal Test Procedure emissions from five test vehicles at 20°, 40°, and 75°F test temperatures using higher aromatic gasoline (50 vol %) with volatility adjustment and a diesel fuel (40 vol %). The results of the work with gasoline-fueled vehicles show hydrocarbon, carbon monoxide, and benzene emissions increase with decreasing ambient temperatures. The formaldehyde emissions tend to decrease with or remain the same at lower ambient temperature operation. The benzene results were higher for the aromatic-enriched gasoline, yet the measured benzene level in the aromatic-enriched gasoline was about one-third the level in the commercial gasoline. These results show that the benzene emissions are associated with the nonbenzene aromatic components in the

gasoline fuel. The particulate emissions for the low and high aromatic fuels were similar. 1 ref., 2 figs., 7 tabs.

24105 **(UCID—21303) Petroleum Geochemistry Project: Quarterly report, October-December 1987.** Braun, R.L.; Burnham, A.K. (Lawrence Livermore National Lab., CA (USA)). 20 Jan 1988. Contract W-7405-ENG-48. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005884/JAW.

The purpose of this project is to develop and test improved chemical kinetic models of petroleum generation and expulsion. In the past quarter, we implemented improved phase equilibrium calculations into our detailed pyrolysis model PYROL as a step towards calculating expulsion efficiencies, fixed several limitations in our regression analysis program KINETICS, compared pyrolysis kinetics obtained from Rock Eval and oil evolution experiments, and explored the differences in product generation from kerogens and whole rocks. 10 refs., 7 figs., 5 tabs.

0250 Combustion

REFER ALSO TO CITATION(S) 24104

24106 **(EMR/MSL—87-92/IR) Combustion trials with syncrude coke and Minto coal in the Mineral Sciences Laboratories circulating fluidized bed combustor: sulphur and metals capture and metallic corrosion.** Hamer, C.A.; Liang, D.T.; Kearns, J.B. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Mineral Sciences Labs.). Jul 1987. 65p. (MICROLOG—87-05181). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Syncrude byproduct coke and Minto coal were combusted with limestone addition in a 100 mm diameter, 2800 mm high pilot-scale circulating fluidized bed combustor. The objective was to investigate the emissions of SO/sub 2/ and heavy metals, their capture with limestone sorbents, and metallic corrosion. With Fort McMurray limestone, greater than 90% of the SO/sub 2/ was captured and 93% of the vanadium and all of the nickel were accounted for in the ashes. The sulphur capture with Elmtree and Havelock limestones was in the 70-75% range. Sulphidation-oxidation type corrosion occurred with 304 stainless steel probes exposed for 125 h at the combustor temperature of 850/sup 0/C. The type and degree of corrosion was similar for both fuel trials and also similar to that found in tests in bubbling fluidized bed units. There was no evidence of accelerated corrosion attributable to the vanadium content of the coke. 14 figs., 18 tabs.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 24085, 24539

0301 Reserves

REFER ALSO TO CITATION(S) 24537

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 24087

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 24092

24107 **(ERCB—D/87/9) Norcen Energy Resources Limited application for approval of a gas processing plant in the Campbell-Namao Field.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 15 Jul 1987. 13p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $N/C.

Norcen Energy Resources Limited applied August, 1986 for approval to construct and operate a sour gas processing plant. Interventions were filed by concerned residents and landowners in the area. The main issues to be addressed by the Energy Resources Conservation Board were the purpose, location, and impacts of the proposed plant and consideration of alternative methods of sulfur disposal. Views are presented on behalf of the applicant, intervenors, and the Board regarding these issues. Having considered the evidence, the Board decided the proposed plant would meet existing regulations and requirements for safeguarding public health and the natural environment. Evidence showed the plant could be built and operated with minimal impact on the area. The Board was therefore prepared to issue an approval to Norcen for the construction and operation of the gas plant.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 24537

24108 **(DOE/EIA—0130(87/12)) Natural gas monthly, December 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 25 Feb 1988. 136p. NTIS, PC A07 - GPO. Order Number DE88006950/JAW.

Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer related activities and underground storage data are also reported. From time to time, feature articles designed to assist readers in using and interpreting the natural gas information are included.

24109 **(NP—8770085) Natural gas - markets and prospects.** (Deutsche Shell A.G., Hamburg (Germany, F.R.). Abt. Information und Presse). Feb 1986. 17p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770085/JAW.

Access is facilitated to the regional natural gas market prospects and the future prospects of natural gas as an energy source. Among the regions investigated are Western Europe, North America and South America, the Soviet Union and Eastern Europe, Africa and the Middle East, Asia and Australasia. The diagrams provided show the main distribution lines or pipelines, respectively.

24110 (NP—8770091, pp 3-12) **Natural gas and its importance for the glass industry.** Poschinger, G. (Ferngas Nordbayern G.m.b.H., Bamberg, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient and non-polluting techniques for producing industrial glass.

The advantages of energy from natural gas esp. for the glass industry are described. The development of natural gas consumption in West Germany is compared to that of other energies, the consumption is indicated per branch of industry. The main issue here is the distribution of various sources of energy in the glass industry. The advantages of natural gas in terms of safety of supplies, environmental benefits and rational utilization are emphasized. (HLN).

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 25014

24111 **(CONF-8710210—5) Effects of pipeline installation on soil properties and crop production in the Oklahoma.** Taylor, J.D.; Zellmer, S.D.; Carter, R.P. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03. Order Number DE88006003/JAW.

From 4. symposium on environmental concerns in rights-of-way management; Indianapolis, IN, USA (25 Oct 1987).

In the fall of 1983, a pipeline was installed in a semiarid agricultural ecosystem in Beaver County, Oklahoma, using the single-ditch installation method. Changes in the soil properties and crop production were monitored by studying three transects at five sites

(one pasture and four crop production) for three years. Soils were measured for bulk density, moisture retention capacity, chemical characteristics, vegetation reestablishment, and crop production. The results of analyses of the disturbed soils indicated lower or unchanged densities, increased or unchanged moisture retention capacities, and acceptable levels of soil nutrients. In three years, plant cover on the pasture site was reestablished, and crop yields on the pipe ditch transects on the other sites have increased substantially. The single-ditch method has either positive or negligible impacts on semiarid agricultural ecosystems. 24 refs., 2 figs., 3 tabs.

24112 **(CWS—22) Preliminary assessment of the effects of the proposed Polar Gas Pipeline and other hydrocarbon development projects on waterfowl of the northern Mackenzie Valley.** Boothroyd, P.N. (Canadian Wildlife Service, Winnipeg, Manitoba). 1987. 119p. (MICROLOG—87-06124). Canadian Wildlife Service. Western and Northern Region, Environment Canada, 501 University Cres., Winnipeg, Man., Canada R3T 2N6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Aerial surveys were conducted in June, July and August, 1985 to determine numbers and distribution of waterfowl along the proposed Polar Gas pipeline route and Parsons Lake lateral in the Mackenzie River valley. Waterfowl densities were low along most of the route except for the segment on Richards Island in the Mckenzie Delta where tundra swans were most abundant. Possible scenarios of pipeline construction and oil and gas development in the Mackenzie Delta/Tuctoyaktuk Peninsula area are discussed and the potential effects on waterfowl are assessed. Recommendations are made with the intent of ensuring protection of waterfowl population and important habitat.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 24107, 24537

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 24111, 24686

0340 Combustion

REFER ALSO TO CITATION(S) 24585, 24939, 24940

04 OIL SHALES AND TAR SANDS

REFER ALSO TO CITATION(S) 24085

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 24088, 24093

24113 **(PCPP/RD—8704) Separation of saturates and aromatics from Syncrude middle distillate. Final report.** Spiro, J.G.; Reid, J.A.; Notzl, H.; Simmons, R.A.; Dymock, K.R. (Petro-Canada Products, Sheridan Park, Ontario. Research and Development Centre). Apr 1987. 204p. (MICROLOG—87-04532). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The overall objective was to evaluate the feasibility of producing high-quality transportation fuels from synthetic crude middle distillate fractions by solvent extraction. This processing will produce saturate and aromatic-rich streams from low-quality middle distillates derived from synthetic crudes. The saturate stream will readily make high-quality transportation fuels, while the aromatic-rich stream will be available for severe hydrogenation without degradation of the high-quality components. The specific objectives were the comparison of candidate extraction solvents with sulphur dioxide, the selection of a promising solvent, and design, construction and operation of a bench-scale extraction unit with synthetic crude middle distillates, and the evaluation of the economic feasibility of an optimum solvent extraction process. Presented are extraction data on two different synthetic middle distillates, representing the two major Canadian sources of synthetic crude (Suncor and Syncrude tar sand upgrading plants). Twelve different organic solvents were rated on properties such as distribution coefficients for saturates and aromatics, and the two most promising organic solvents were selected for further study. A solvent extraction process to separate the aromatic and saturated hydrocarbon components of synthetic middle distillates proved to be technically feasible.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 24094, 24105

24114 **(ORF—82/5) Chemical characterization of the polynuclear aromatic hydrocarbons in fractions boiling above 350/sup 0/C. Final report.** Das, B.S.; Kane, D. (United Technology and Science, Inc., Toronto, Ontario (Canada); Ontario Research Foundation, Sheridan Park (Canada)). 30 Jun 1982. 122p. (MICROLOG—83-2112). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This work describes the separation and characterization by instrumental analysis techniques of polynuclear aromatic hydrocarbon (PNA) compounds in six crude oil/bitumen samples provided by the Energy Research Laboratory (ERL) of the Canadian Institute of Mineral and Energy Technology (CANMET). The samples were first processed by distillation to obtain the fractions boiling above 350/sup 0/C. These distillation residues (b.p.>350/sup 0/C) were then deasphaltened using n-pentane. The deasphaltened residues (maltene fractions) were further separated into compound types (saturates, monoaromatics, diaromatics, polyaromatics, polar polyaromatics) by liquid-solid chromatography (LSC). Prior to instrumental analysis by high performance liquid chromatography (HPLC), each ployaromatics fraction was subjected to an acid/base extraction procedure to remove any polar material. Several of the sample fractions were analysed for carbon, hydrogen, nitrogen and sulphur. Methods for the analysis of a mixture of 24 PNA model compounds consisting of both methylated and unsubstituted PNA compounds were developed based on the chromatographic techniques of C/sub 8/-reversed-phase HPLC using ultraviolet and flourescence detection (HPLC-UV/Flourescence) and capillary GC using flame-ionization detection (GC-FID) and mass spectrometric characterization (GC-MS). These methodologies were subsequently used for the analysis and characterization of PNA compounds in the polyaromatic fractions. The samples were quantitatively analyzed by capillary GC-FID with individual peaks tentatively identified by capillary GC-MS.

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 24096, 24933

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 24639

24115 **(INIS-GB—43) Click - nuclear energy.** (International Atomic Energy Agency, Vienna (Austria)). 1986. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780015/JAW.

The activities of British Nuclear Fuels are listed, explained and illustrated. It offers a complete cycle from uranium enrichment, fuel manufacture and transport, to fuel reprocessing and radioactive waste management. The uranium fission process is explained as are the basic principles of Magnox and Advanced Gas Cooled Reactors. BNFL's head office is at Risley in Cheshire and it has sites at Capenhuust (uranium enrichment plant). Springfields (fuel manufacturing plant) and Sellafield (fuel reprocessing plant). It owns Calder

Hall and Chapelcross nuclear power stations. Safety is a major consideration and strict safety regulations are observed at all sites. BNFL also encourages public interest in its activities. This booklet is part of its public information effort. (U.K.)

0501 Reserves, Exploration, And Mining

24116 **(INFO—0154) Elliot Lake study: factors affecting the uranium mine working environment prior to the introduction of current ventilation practices.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); DSMA Atcon Ltd., Toronto, Ontario (Canada)). Mar 1985. 119p. NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701925/JAW.

A study was carried out to assist in the retrospective assessment of the underground environment that existed in the Elliot Lake uranium mines in the late 1950's and early 1960's. The environmental conditions and work practices of the late 1950's were established by a combination of literature review and interviews with veteran miners. The practices of the 1950's were imitated in a pilot raise, and extensive measurements of the radiation environment were made. Realistic values of radon and thoron daughter production and removal rates were obtained. The computer model demonstrated that it could reproduce all the observed features of the radiation environment given realistic input parameters. A realistic time and space dependent computer model was used to calculate and compare the average expsoure of the miner in the 1950's with the exposure that would be expected from contemporary measurements, and with that of the miner today. The calculated exposure is about half of that expected from contemporary measurements, which gives assurance that previous exposures for pilot raise miners were not underestimated. Relative to today's miner, the average exposure of the typical raise miner of the 1950's is estimated as three times higher for radon daughters, equal for thoron daughters, equal for exposure to gamma radiation, but much higher for uranium and quartz dust.

24117 **(INFO—0167-2) Determination of the contribution of long-lived dust to the committed dose equivalent received by uranium mine and mill workers in the Elliot Lake area. Volume 2 - appendices.** Duport, P.J.; Edwardson, E. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 26 Nov 1985. 124p. NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701930/JAW.

In 1945 K.R. May developed and described one of the first cascade impactors. It was used to collect airborne fine particles and classify them inertially into several aerodynamic size ranges. This allowed the determination of size distribution and any subsequent analysis to be carried out as a function of particle size. Today cascade impactors are used extensively for collecting airborne fine particles for gravimetric or chemical analysis, air quality monitoring and stack sampling. A cascade impactor should be calibrated under actual working conditions. In the absence of impactor calibration, the performance may be predicted through numerical calculation techniques developed by Ranz and Wong (1952). Stern et al (1962) or the best available theory developed by Marple et al (1974). The experimental data of Rao and Jaenicke and Blifford, agree well with Marple's theory provided that the conditions of the experiment correspond with those of the numerical model.

24118 **(INIS-mf—11134) Eldorado's annual report, 1984.** (Eldorado Nuclear Ltd., Ottawa, Ontario (Canada)). 1985. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701935/JAW.

In 1984 Eldorado Nuclear Ltd. and its subsidiaries achieved record revenues of $208.1 million and had a net profit of $4.4 million. Canada has become the largest producer and exporter of uranium in the western world; Eldorado and three other Canadian companies rank among the eight largest suppliers in the world. Eldorado produced 2029 tonnes of uranium and processed 4399 tonnes in 1984. More of the mineral exploration budget is being directed towards the discovery of other metals and minerals. Uranium exploration is to focus on the delineation of prospective ore bodies close to the Rabbit Lake mill. During the year the Canada Development Investment Corporation, Eldorado's parent company, increased its efforts to find new owners for Eldorado in order to return ownership to the private sector.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 24135

24119 **(EUR—10948) Determination of oxygen potentials and O/M ratios of oxide nuclear reactor fuels by means of an automated solid state galvanic cell.** Toci, F.; Cambini, M.; Ewart, F.T. (Commission of the European Communities, Ispra (IT) Joint Research Centre; AERE Harwell, Oxford (UK)). (Commission of the European Communities, Luxembourg). 1987. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752569/JAW.

An automated version of the electromotive force (emf) cell for the determination of oxygen activities and oxygen to metal ratios of oxide nuclear reactor fuel, irradiated or not, is reported together with some measurements. 9 figs., 17 refs. In appendix a method is described for preparing suitable electrolyte crucibles.

24120 **(INIS-GB—47) Fuel handling plant and site ion exchange effluent plant.** (International Atomic Energy Agency, Vienna (Austria)). 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780016/JAW.

Two new facilities at Sellafield are explained. The fuel handling plant has been built to provide facilities for the receipt, storage and decanning of Magnox fuel and to increase the capacity and throughput for Magnox reprocessing. AGR fuel will also be stored and dismantled in the plant but not reprocessed until the Thermal Oxide Reprocessing Plant (THORP) comes into operation. The plant is described and illustrated with photographs. The route of the fuel through the plant is shown. The Site Ion Exchange Effluent Plant (SIXEP) is designed to reduce liquid radioactive discharges to a few percent of peaks levels. The SIXEP process is shown schematically and in photographs. (UK)

24121 **Radiography of liquid metal fuel combustion.** Parnell, L.A.; Katz, D.L.; Gilchrist, J.T.; Bryant, L.E.; Lucero, J.P.; Zerwekh, W.D. (Naval Ocean Systems Center, San Diego, CA). pp 1-6 of Proceedings of the 22nd intersociety energy conversion engineering conference. New York, NY; American Institute Aeronaut and Astronaut (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Technical Paper 879389.

Liquid metal fuels are being employed as Rankin cycle heat sources for undersea vehicle propulsion systems, necessitating investigation of the fundamental chemical, thermodynamic, and hydrodynamic processes which occur during the confined combustion of these fuels. Results of the development of techniques for the use of flash X-ray radiography to investigate these processes is presented. Experimental combustors designed to permit studies of the combustion zone and fluid dynamics of the jet-driven circulating flow in the fuel bath are described. Radiographic images showing the reaction zone, multiphase flow structures and the behavior and mixing characteristics of the products-rich phase are shown, demonstrating the utility of this experimental technique in energy conversion research.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 24120, 24135, 24153, 24207, 24504

24122 **(CEA-CONF—9131) Continuous rotary dissolver for light water fuels. Prototype testing.** Lorrain, B.; Saudray, D.; Tarnero, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). Aug 1987. 12p. (In French). (CONF-870801—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752213/JAW.

From International conference on nuclear fuel reprocessing and waste management; Paris, France (24 Aug 1987).

An industrial prototype with a capacity of 4 tons of uranium per day is described. Specifications include sequential continuous

dissolution, criticality safety, semi-continuous fuel feeding, dissolution in boiling HNO/sub 3/ 2.7-3.3 M for solution containing 200-300 g/l of uranium, fissile material monitoring in hulls, interchangeable mechanical parts without deconnecting active pipes. The different tests are described: hull transfer, hull rinsing, components, dissolution, iodine contamination factor and progressive improvement of the prototype is followed.

24123 **(CEA-CONF—9136) Mixed oxide fuel dissolution: Program of studies and first results.** Goumondy, J.P.; Gue, J.P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). Aug 1987. 5p. (In French). (CONF-870801—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752217/JAW.

From International conference on nuclear fuel reprocessing and waste management; Paris, France (24 Aug 1987).

Aiming at decreasing enriched uranium needs and at a valorization of plutonium from reprocessing of PWR spent fuels, Electricite de France decided, since fall 1987, to introduce mixed oxide UO/sub 2/ - PuO/sub 2/ fuel elements at a ratio Pu/(U+Pu) between 5 and 9 %. 1/3 of reactor load is so replaced by recycled plutonium. It was necessary to verify that the dissolution of these fuels in industrial conditions does not leave PuO/sub 2/ residues. First tests show that dissolution kinetics and relative losses in U and Pu (respectively 0.01 % and 0.03 % after 3 hours in boiling nitric acid) are close to those obtained with standard enriched UO/sub 2/ fuels.

24124 **(ENEA-RT-COMB—87-13) Alpha contaminated liquid effluent monitoring. Development of a measurement method based on alpha spectrometry.** Aparo, M.; Mattia, B.; Bianchini, E.; Frazzoli, F.V. (ENEA, Casaccia (Italy). Centro Ricerche Energia; Rome Univ. (Italy). Dip. di Energetica). (ENEA, Rome (Italy)). 1987. 46p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701798/JAW.

The present report takes into consideration the possibility to carry out an in-line control of activity in liquid streams of fuel cycle nuclear plants, epecially for waste streams. The instrument developed for this purpose, has been characterized by means of static and dinamic measurements with Pu and Am bearing solutions. The results so far obtained show that the minimum detectable Pu amount is about .01mg/l and that it is possible to apply such a technique as alarm system able to detect the overcoming of a present threshold of actinides concentrations. The report also presents an approach to the spectra deconvolution in order to determine the amount of single isotopes.

24125 **(ENEA-RT-TIB—86-48) Hollow fiber liquid supported membranes. Mathematical modeling.** Violante, V. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1987. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701805/JAW.

The hollow fiber system are well known and developed in the scientific literature because of their applicability in the process separation units. The authors approach to a mathematical model for a particular hollow fiber system, usin liquid membranes. The model has been developed in order to obtain a suitable tool for a sensitivy analysis and for a scaling-up. This kind of investigation is very usefull from an engineering point of view, to get a spread range of information to build up a pilot plant from the laboratory scale.

24126 (INIS-mf—10573, pp 23) **Fluoride reprocessing line for spent fast reactor fuel.** Novy, P. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). 1985. (In Czech). NTIS (US Sales Only), PC A03/MF A01. Order Number DE87701488/JAW. (CONF-8506335—Pt.3).

From Scientific and technical conference on the occasion of the 30th anniversary of the Czechoslovak Nuclear Research Institute; Rez, Czechoslovakia (6 Jun 1985).

24127 **(INIS-mf—11648) Waste management at WAK.** Kuhn, K.D.; Willax, H.O. (Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen m.b.H., Eggenstein-Leopoldshafen (Germany, F.R.)). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88752661/JAW.

After a short description of the WAK plant and its reprocessing and intervention activities, types and sources of WAK wastes are described. Roughly half of the waste volume is generated during reprocessing, the other half during intervention periods. Most of the waste is transported to KfK for conditioning. Only waste from the head end cell is cementated on the spot. HLLW is stored in stainless steel tanks. Some results from analyzing this stuff are given. The corrosion behavior is acceptable for medium term storage.

24128 **(SCSIN—U-3-2-A-82) General requirements applicable to the production, inspection, processing, packaging and storage of various types of waste resulting from the reprocessing of fuels irradiated in pressurized light water reactors.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Sep 1982. 19p. (SIN—4644-BIS-22). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752184/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analysises and the clear understanding between persons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem this necessary, while specifying the applicability conditions. This rule is intended to define the general provisions applicable to the production, inspection, processing, packaging and storage of the different types of wastes resulting from the reprocessing of fuels irradiated in a PWR.

24129 **(SCSIN—U-3-2-B-82) General requirements applicable to the production, inspection, processing, packaging and storage of high activity wastes packed in glass form and resulting from the reprocessing of fuels irradiated in pressurized light water reactors.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Nov 1982. 9p. (SIN—5456-82). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752183/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analysises and the clear understanding between persons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem this necessary, while specifying the applicability conditions. This rule is intended to define the general provisions applicable to the production, inspection, processing, packaging and storage of wastes, resulting from the reprocessing of fuels irradiated in a PWR, packaged in the form of glass.

24130 **(SCSIN—U-3-2-C-84) Specific provisions applicable to the production, inspection, treatment, packaging and interim storage of low and medium level bituminized wastes resulting from the reprocessing of fuels irradiated in pressurized water reactors.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Apr 1984. 11p. (SIN—1914-84). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752182/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analysises and the clear understanding between persons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem this necessary, while specifying the applicability conditions. This rule sets forth the specific provisions applicable to the production, inspection, treatment, packaging and interim storage of the wastes, resulting from the reprocessing of fuels irradiated in a PWR and coated in bitumen.

24131 **(SCSIN—U-3-2-D-85) Particular provisions applicable to the production, inspection, treatment, packaging and interim storage of wastes immobilized in cement, resulting from the reprocessing of fuels irradiated in pressurized light water reactors.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Feb 1985. 8p. (SIN—A-589-BIS-85). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752181/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analysises and the clear understanding between persons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem this necessary, while specifying the applicability conditions. This rule is intended to stipulate the specific provisions applicable to the production, inspection, treatment, packaging and interim storage of the wastes, resulting from the reprocessing of fuels irradiated in a PWR and immobilized in cement.

0509 Transport And Storage

24132 **(EGG-M—21986) Quality assurance, in the transportation for the waste from the TMI-2 reactor.** Bonnough, T.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. 12p. (CONF-8609125—5). NTIS, PC A03. Order Number DE88006743/JAW.

From 13. annual American Society for Quality Control Energy Division conference; Ft. Lauderdale, FL, USA (21 Sep 1986).

Quality assurance for the removal of waste from TMI-2, its packaging, and transportation required a significant cooperative effort as the operational mode for the quality assurance program. The waste generator, the shipper, and waste storage organizations are individually and collectively responsible for the overall quality program, and its effective implementation. This paper defines the work that is being accomplished under DOE TMI-2 Programs, reflecting the Quality Assurance emphasis, and outlines how the quality achieving and assuring activities are being, or have been accomplished. This paper focuses on the quality assurance roles and responsibilities of (1) the DOE Idaho Operations Office (DOE-ID), and (2) EG and G Idaho, and the QA interface with other organizations to accomplish the mission.

24133 **(SAND—88-0190) Sample problem manual for benchmarking of cask analysis codes.** Glass, R.E. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1988. Contract AC04-76DP00789. 43p. (TTC—0780). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006596/JAW.

A series of problems have been defined to evaluate structural and thermal codes. These problems were designed to simulate the hypothetical accident conditions given in Title 10 of the Code of Federal Regulation, Part 71 (10CFR71) while retaining simple geometries. This produced a problem set that exercises the ability of the codes to model pertinent physical phenomena without requiring extensive use of computer resources. The solutions that are presented are consensus solutions based on computer analyses done by both national laboratories and industry in the United States, United Kingdom, France, Italy, Sweden, and Japan. The intent of this manual is to provide code users with a set of standard structural and thermal problems and solutions which can be used to evaluate individual codes. 19 refs., 19 figs., 14 tabs.

0510 Marketing, Economics, And By-products

24134 **(INIS-GB—53) Annual report and accounts 1985-1986.** (International Atomic Energy Agency, Vienna (Austria)). 1986. 64p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780017/JAW.

British Nuclear Fuels plc (BNFL) provides a complete nuclear fuel cycle service at its five sites in N.W. England and southern Scotland. This covers fuel manufacture (at Springfields), uranium enrichment (at Capenhurst), reprocessing (at Sellafield), reprocessing engineering (at Risley) and the operation of two nuclear power stations (at Chapelcross and Calder Hall). BNFL employs over 16,000 people and had a turnover of over Pound 600 million in 1986. The report covers all aspects of the Company's work and is illustrated with photographs and diagrams. It highlights the work of some individuals who work in a variety of areas for the company. Safety and environmental protection are emphasised. The accounts are set out in detail with notes of explanation on the balance sheet. (UK)

24135 **(INIS-GB—54) Annual report and accounts 1984/1985.** (International Atomic Energy Agency, Vienna (Austria)). 1985. 64p. NTIS (US Sales Only), PC A4/MF A01. Order Number DE88780018/JAW.

All aspects of British Nuclear Fuels (BNFL) work are covered in this report. The company offers a complete fuel cycle service from fuel fabrication to spent fuel reprocessing. Each of the operations undertaken by BNFL (on five sites in northern England and southern Scotland) is explained and illustrated with photographs and drawings. The accounts show that in 1985 BNFL employed over 15,000 people and had a turnover of Pound 545 million. (UK)

0520 Waste Management

REFER ALSO TO CITATION(S) 24127, 24128, 24129, 24130, 24131, 24431, 24610, 24699, 24851, 25056, 25058, 25060, 25064, 25065, 25066, 25067, 25068, 25086, 25087, 25092, 25093, 25250, 25473

24136 **(AERE-R—12580) Evaluation of solidified highly-active waste: leaching of MW glass containing Pu and Am. Final report - December 1986.** Hall, A.R.; Boult, K.A.; Marples, J.A.C. (UKAEA Harwell Lab. Chemistry Div.; Department of the Environment, London (UK)). Oct 1987. 16p. (DOE-RW—87.042). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752760/JAW.

Glass samples have been made on the 20g scale from MW glass frit and inactive simulants of the Magnox and THORP High Level Wastes that are expected to be vitrified in the Windscale Vitrification Plant (WVP). Before melting, the simulant calcines were doped with realistic proportions of Tc-99, Np-237, Pu-239/240 and Am-241. The proportions of waste and the temperatures and times of melting were varied on a matrix which went well outside the limits of these parameters that could occur in the WVP. Samples cut from the melts were leach tested in distilled water at 25/sup 0/ C and 70/sup 0/C in a static test where the leachant volume to specimen surface area ratio was 100mm. Neither the mass loss leach rates nor the normalised specific element leach rates for the isotopes listed above were sensitive to the waste content or the time or temperature of glass melting in the range tested. The leach rates of the THORP glasses were about ten times higher than those of the Magnox glasses. At 70/sup 0/C the leach rates of the Magnox glasses decreased in the order weight > Tc > Np ≧ Pu > Am with a range from 20 to 0.1 microgram.cm/sup -2/.day/sup -1/.

24137 **(AERE-R—12744) Long term solute diffusion in a granite block immersed in sea water.** Jefferies, N.L. (UKAEA Harwell Lab. Chemistry Div.; Department of the Environment, London (UK)). Jul 1987. 14p. (DOE-RW—87.082). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752761/JAW.

Solute diffusion profiles for Cl/sup -/, Br/sup -/, F/sup -/ and So/sub 4//sup --/have been measured in a granite block which was immersed in the sea at Falmouth, Cornwall, for 30 years. The apparent diffusion coefficient and the solute accessible porosity have been estimated from the Cl/sup -/ and Br/sup -/ profiles, and these values have been compared with previously obtained laboratory data. So/sub 4//sup --/ and F/sup -/ are partially sorbed in the granite block, and their sorptivity is estimated from an analysis of their pore water concentration profiles.

24138 **(CEA-DPS—87-04) Model for assessing the radiological impacts of deep sea disposal of radioactive wastes: development of the model and preliminary results.** Poulin, M.; Chartier, M.; Durrieu de Madron, X. (Ecole Nationale Superieure des Mines de Paris, 77 - Fontainebleau (FR)). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). Oct 1987. 79p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752562/JAW.

A new numerical model has been developed in France to assess the radiological consequences of low level radioactive waste disposal on the sea bottom of the Atlantic Ocean. It is a box model covering the world ocean with a finer resolution in the North Atlantic and near the Nuclear Energy Agency dumpsite. The main processes involved in the nuclides transfer from the drums to man are modelled or parameterized: time variations of the nuclides release, advection and diffusion by the ocean fluid, adsorption-desorption on particles, sedimentation and burial of sediments, transfers through organisms living in the sea (fishes, crustaceans, molluscs, seaweeds, plankton,...). The dose equivalent to critical group members and the collective dose equivalent are assessed. A sensitivity analysis of the model has been performed to assess the reliability of the dose calculations. An intercomparison exercise has been achieved with two other independent models on a benchmark problem.

24139 **(CONF-8609393—1) A survey of the radioactive wastes in the Federal Republic of Germany.** Brennecke, P. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). 1986. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900409/JAW.

From Finnish-German seminar on nuclear waste management; Espoo, Finland (23 Sep 1986).

In the Federal Republic of Germany radioactive wastes originate from reprocessing of spent fuel elements, the operation of nuclear power plants, the collecting depots of the federal states, the nuclear research establishments, the nuclear fuel cycle industry, the decommissioning and dismantling of nuclear facilities and other waste producers. These wastes maybe disposed of in the former Konrad iron ore mine or in the planned repository in the Gorleben salt dome. To provide the necessary data base for the planning work being conducted by the Physikalisch-Technische Bundesanstalt, an extensive characterization of these wastes has been performed. Using of today's figures and assumptions on the further growth of nuclear facilities, future amounts of the waste package volume have been estimated. On the basis of a site-specific safety assessment comprising the operational and post-operational phase of the planned Konrad repository, preliminary waste acceptance requirements have been derived. Waste packages intended to be disposed of in this facility must meet these requirements. 18 refs., 12 figs.

24140 **(CONF-8609393—2) The German approach to the disposal of radioactive wastes.** Warnecke, E. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). 1986. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900440/JAW.

From Finnish-German seminar on nuclear waste management; Espoo, Finland (23 Sep 1986).

In the Federal Republic of Germany, the Physikalisch-Technische Bundesanstalt (PTB) is responsible for the construction and operation of the repositories in which radioactive wastes will be disposed of; two repositories are Gorleben (salt dome; for all types of radioactive wastes) and Konrad (abandoned iron ore mine; for radioactive wastes with negligible thermal influence upon the host rock). According to the safety criteria for the disposal of radioactive wastes in a mine, the safety of a repository has to be demonstrated by a site specific safety assessment for the normal operation of a repository, for incidents in the operational phase, and the post-operational phase. These assessments result in waste acceptance requirements. Preliminary waste acceptance requirements have been set up for the planned Konrad repository. In the Kernforschungsanlage Juelich (KFA), a group for the quality control of radioactive waste has been established on behalf of the PTB. The application documents for Konrad have been completely submitted to the licensing authority. The operation of the Konrad repository is anticipated for the year 1990. Preliminary safety assessments have only been performed for the Gorleben site on the basis of model assumptions. These are planned to be updated in 1986/1987 on the basis of the results of the site investigation from surface and on new data of the wastes to be disposed of. 30 refs.

24141 **(DOE/ID/12377—T1) Compilation of state-by-state low-level radioactive waste information: National Low-Level Waste Management Program: Final report.** (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1987. Contract FG07-82ID12377. 398p. NTIS, PC A17; 3; GPO Dep. Order Number DE88004583/JAW.

The document addresses various aspects of low-level radioactive waste (LLRW) generated and managed during the calendar years 1982 and 1984. Surveys of individual LLRW generators were conducted for the two referenced years by state radiation control agencies. From survey data, a wide variety of state, regional, and national reports were developed to reflect volumes and radioactivity of generated radioactive waste, and to reflect methods used by the generators in managing the waste, including both on-site and off-site management. EG and G Idaho, Inc., had developed and maintained this information and made it immediately available to participating agencies through DOE's computerized information network. 20 refs., 9 tabs.

24142 **(DOE/RW—0163) Consultation draft: Site characterization plan overview, Deaf Smith County Site, Texas: Nuclear Waste Policy Act (Section 113).** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Jan 1988. 125p. H. Order Number TI88006439/JAW.

The Department of Energy (DOE) is preparing a site characterization plan for the candidate site in Deaf Smith County, Texas. The DOE has provided, for information and review, a consultation draft of the plan to the State of Texas and the US Nuclear Regulatory Commission. The site characterization plan is a lengthy document that describes in considerable detail the program that will be conducted to characterize the geologic, hydrologic, and other conditions relevant to the suitability of the site for a repository. The overview presented here consists of brief summaries of important topics covered in the consultation draft of the site characterization plan; it is not a substitute for the site characterization

plan. The arrangement of the overview is similar to that of the plan itself, with brief descriptions of the repository system - the site, the repository, and the waste package - preceding the discussion of the characterization program to be carried out at the Deaf Smith County site. It is intended primarily for the management staff of organizations involved in the DOE's repository program or other persons who might wish to understand the general scope of the site-characterization program, the activities to be conducted, and the facilities to be constructed rather than the technical details of site characterization. 15 figs., 1 tab.

24143 **(DP-MS—87-112) Demonstration of remotely operated TRU waste size reduction and material handling equipment.** Looper, M.G.; Charlesworth, D.L. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 10p. (CONF-880201—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006663/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

The Savannah River Laboratory (SRL) is developing remote size reduction and material handling equipment to prepare ^{238}Pu contaminated waste for permanent disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico. The waste is generated at the Savannah River Plant (SRP) from normal operation and decommissioning activity and is retrievably stored onsite. A Transuranic Waste Facility for preparing, size-reducing, and packaging this waste for disposal is scheduled for completion in 1995. A cold test facility for demonstrating the size reduction and material handling equipment was built, and testing began in January 1987. 9 figs., 1 tab.

24144 **(DP-MS—87-119) Savannah River Plant Separations Department mixed waste program.** Wierzbicki, W.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 10p. (CONF-880201—19). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006506/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

The Department of Energy's (DOE) Savannah River Plant (SRP) generates radioactive and mixed waste as a result of the manufacture of nuclear material for the national defense program. The radioactive portion of the mixed waste and all nonhazardous radioactive wastes would continue to be regulated by DOE under the Atomic Energy Act. The Separations Department is the largest generator of solid radioactive waste at the Savannah River Plant. Over the last three years, the Separations Department has developed and implemented a program to characterize candidate mixed-waste streams. The program consisted of facility personnel interviews, a waste-generation characterization program and waste testing to determine whether a particular waste form was hazardous. The Separations Department changed waste-handling practices and procedures to meet the requirements of the generator standards. For each Separation Department Facility, staging areas were established, inventory and reporting requirements were developed, operating procedures were revised to ensure proper waste handling, and personnel were provided hazardous waste training. To emphasize the importance of the new requirements, a newsletter was developed and issued to all Separations supervisory personnel.

24145 **(DP-MS—87-120) Development of a plutonium-239 recovery incinerator.** Williams, S.; Charlesworth, D.L. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 10p. (CONF-880201—18). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006662/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

A Plutonium-239 Recovery Incinerator is being developed for the Savannah River Plant (SRP) to reduce the volume of solid glovebox waste and to allow recovery of Pu-239 from the waste. The process will also allow treatment of some waste materials that are not certifiable for disposal at the Waste Isolation Pilot Plant (WIPP). It will consist of two electrically heated combustion chambers (furnace and afterburner) and a dry filtration off-gas system. A unique feature of the process is that it uses pyrohydrolysis to produce an ash that is amenable to Pu recovery through nitric acid/HF dissolution. A series of thermogravimetric (TGA) analyses have been performed to characterize potential incinerator feed materials. A functioning furnace mockup was built and operated to demonstrate electrically-heated pyrohydrolysis operation. 8 refs., 4 figs.

24146 **(DP-MS—88-20) High level waste vitrification at the SRP [Savannah River Plant] (DWPF [Defense Waste Processing Facility] summary).** Weisman, A.F.; Knight, J.R.; McIntosh, D.L.; Papouchado, L.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant; Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 15p. (CONF-880201—20). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006503/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

The Savannah River Plant has been operating a nuclear fuel cycle since the early 1950's. Fuel and target elements are fabricated and irradiated to produce nuclear materials. After removal from the reactors, the fuel elements are processed to extract the products, and waste is stored. During the thirty years of operation including evaporation, about 30 million gallons of high level radioactive waste has accumulated. The Defense Waste Processing Facility (DWPF) under construction at Savannah River will process this waste into a borosilicate glass for long-term geologic disposal. The construction of the DWPF is about 70% complete; this paper will describe the status of the project, including design demonstrations, with an emphasis on the melter system. 9 figs.

24147 **(DP-MS—88-30) Probabilistic assessment of radiological impacts from transuranics in waste at the Savannah River Plant.** Cohen, J.; Smith, C.F.; Cook, J.R.; King, C.M. (Science Applications International Corp., Pleasanton, CA (USA); Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 9p. (CONF-880201—21). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006505/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

These results indicate that, depending upon the degree of conservatism one desires to apply in selecting input parameters, the calculated dose could range from relatively insignificant values to doses well in excess of current standards for radiation exposure. Although a complete probabilistic assessment of all radionuclides at all disposal sites is beyond the scope of the present study, the results of the sample problem calculation indicate how incorporation of uncertainty in such calculations can affect the results. However, a serious drawback to such analyses lies in the fact that current regulatory standards provide no clear guidelines that would allow for reasonable interpretation of such results. Accordingly the probabilistic assessment is provided only to demonstrate the potential effect of considering uncertainty in calculational prediction of dose consequences from underground disposal of radioactive wastes. 11 refs., 1 fig., 2 tabs.

24148 **(EUR—10839) Long-term evolution of radio-active waste storage in geological formations: analogy with the weathering of mineral deposits.** Cantinolle, P.; Griffault, L.; Jebrak, M. and others. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (FR)). (Commission of the European Communities, Luxembourg). 1986. 316p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number TI88752566/JAW.

The aim of this study was to select examples of mineral deposits and their weathering environment, showing the long-term behaviour, in geological time, measuring (area, volume) some constituent elements of radio-active waste storage subject to the hazards of hydrogeochemical weathering. Initially, a feasibility study was made to collate data available within the BRGM (mining group and public service) and from literature dealing with weathering of deposits. It was thus discovered that the analogy between radio-active waste storage and mineral deposits could be approached in two different yet complementary ways: - one approach is to observe the behaviour of a mineral deposit in relation to the country rocks. For this a bibliographic metallogenic study was made. The other ap-

proach is to observe the behaviour of chemical elements during deposition of a mineral deposit whose genesis is similar to the spatial and thermal environment of a deposit of radio-active waste in a geological formation. For this two sites were selected corresponding to hydrothermal systems showing strong analogies to those expected in the neighbourhood of the storage sites. These two sites, Langenberg in the Vosges and La Telhaie in Brittany, were the subject of complementary analytical work.

24149 **(EUR—10934) Uncertainty analysis techniques.** Marivoet, J.; Saltelli, A.; Cadelli, N. (Centre d'Etudes de l'Energie Nucleaire, Mol (BE); Commission of the European Communities, Ispra (IT). Joint Nuclear Research Center; Commission of the European Communities, Brussels (BE). Directorate General for Research, Science and Development). (Commission of the European Communities, Luxembourg). 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752568/JAW.

The origin of the uncertainty affecting Performance Assessments, as well as their propagation to dose and risk results is discussed. The analysis is focused essentially on the uncertainties introduced by the input parameters, the values of which may range over some orders of magnitude and may be given as probability distribution function. The paper briefly reviews the existing sampling techniques used for Monte Carlo simulations and the methods for characterizing the output curves, determining their convergence and confidence limits. Annual doses, expectation values of the doses and risks are computed for a particular case of a possible repository in clay, in order to illustrate the significance of such output characteristics as the mean, the logarithmic mean and the median as well as their ratios. The report concludes that provisionally, due to its better robustness, such estimation as the 90th percentile may be substituted to the arithmetic mean for comparison of the estimated doses with acceptance criteria. In any case, the results obtained through Uncertainty Analyses must be interpreted with caution as long as input data distribution functions are not derived from experiments reasonably reproducing the situation in a well characterized repository and site.

24150 **(EUR—11025) R and D programme on radioactive waste disposal into geological formations (study of a clay formation).** Centre d'Etude de l'Energie Nucleaire, Mol. (BE). (Commission of the European Communities, Luxembourg). 1987. 220p. NTIS (US Sales Only), PC A10/MF A01. Order Number TI88752570/JAW.

This report deals with the R and D activities performed by the Belgian Nuclear Research Establishment (SCK/CEN) and its subcontractors concerning the disposal of high-level and long-life conditioned wastes in a deep clay formation, the Boom clay. The studies reported concern equally experimental as theoretical work spread over the following research issues: geochemical characterization of the Boom clay, modelling of radionuclide migration in the clay environment, irradiation effects and corrosion behaviour of candidate canister materials in the Boom clay, geomechanical, construction, backfilling and sealing studies related to underground facilities, regional hydrological investigations of the Mol site and safety and risk analysis. The geomechanical and construction-related studies are to a large extent focused on in situ research, performed along the construction of the underground Hades laboratory. The corrosion studies are also dealing with the preparation of in situ experiments in the same underground laboratory. These various research issues are meant to contribute to the assessment of the technical feasibility and safety of the geological disposal in an argillaceous host formation.

24151 **(EUR—11027) Netherlands approach for assessing the performance and the long-term safety aspects of a high-level waste repository to be mined in a medium-sized salt dome.** Glasbergen, P.; Janssen, L.G.J.; Hamstra, J. (RIVM/LBG, Bithoven (NL); ECN, Petten (NL); Avora, Bergen (NL)). (Commission of the European Communities, Luxembourg). 1987. 93p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752571/JAW.

This report describes the performance assessment work that is being carried out under contract to the European Commission in order to evaluate the isolation capability of a salt dome that is to be used for the disposal of high-level waste. The work is based on the assumption that the normal evolution scenario for radionuclide release from a repository that is mined in a medium size salt dome will be a continuous subrosion of the salt dome. This report is a compilation of the three progress reports published on this subject. It reviews the general regional setting of The Netherlands' reference salt dome and the consideration that led to the new approach in geohydrological modelling. This modelling is based on the assumptions thet the subrosion started 1.2 x 10/sup 6/ years ago and that the future climatic changes remain limited to a continuing Quaternary type of development in average temperatures. It describes the composition of the model used for calculating the subrosion rate with the use of a modified version of the SWIP-2-computer code. And it gives the results of the calculations on both the flank and top subrosion. The main conclusion is that even under very conservative assumptions the calculated subrosion rates are so small that the isolation capability of a salt dome with an adequately designed repository is at least in the order of a million of years.

24152 **(EUR—11081) Potential for creation of a salt dome following disposal of radioactive waste in a salt layer Vol. 1. Laboratory scale numerical computer simulations.** Charo, L.; Habib, P. (Ecole Polytechnique, 91 - Palaiseau (FR)). (Commission of the European Communities, Luxembourg). 1987. 290p. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number TI88752576/JAW.

The study aims at quantifying the possibility of creation of a salt dome from a salt layer in which heat-emitting radioactive waste would be buried. Volume 1 describes the results of numerical computer simulations, and of laboratory-scale models in centrifuges. Volume 2 envisages, in a geological perspective, the origin of salt domes, the mechanisms of their formation, and the associated parameters.

24153 **(GRS—66) Radioactive waste management. Waste forms of high-level radioactive wastes from reprocessing.** Merz, E.; Nowak, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Oct 1987. 111p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88752646/JAW.

First, some general informations are given about radioactive waste, e.g. arising of waste, classification, intermediate deposition and transport, as well as about the multi-barrier concept. Then, emphasis is laid on the internationally favoured vitrification of high-active waste. Safety requirements and the physical-chemical characteristics of the waste forms are described as are the different technical vitrification processes. Moreover, alternative solidification products such as ceramic materials and synthetic rocks were discussed. In addition, the worldwide technical concepts for the management and final disposal of radioactive waste are summarized.

24154 **(INFO—0139) Probabilistic calculation of dose commitment from uranium mill tailings.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); Beak Consultants Ltd., Montreal, Quebec (Canada)). Oct 1983. 98p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701920/JAW.

The report discusses in a general way considerations of uncertainty in relation to probabilistic modelling. An example of a probabilistic calculation applied to the behaviour of uranium mill tailings is given.

24155 **(INIS-GB—119) Way forward. A discussion document.** (United Kingdom Nirex Ltd.). [1988]. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752750/JAW.

Issued in 2 parts: full document and summary.

The document (issued in two parts) concerns the development of a repository for the disposal of low and intermediate-level radioactive waste. The aim of the document is to promote public understanding of the issues involved and to stimulate comment which will assist the Nuclear Industry Radioactive Waste Executive (NIREX) in developing acceptable proposals. A description is

given of the present position with regard to radioactive waste and repository development. The Nirex programme of work is briefly outlined. Finally, some of the issues for discussion are raised. (U.K.).

24156 **(INIS-GB—124) Disposal of radioactive waste in Sweden, West Germany and France.** (Environmental Resources Ltd., London (UK)). Jan 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752779/JAW.

Prepared for the County Councils Coalition.

Representatives from Humberside, Lincolnshire and Bedford County Councils have visited radioactive waste disposal sites in Sweden (Forsmak), West Germany (Konrad) and France (Centre de la Manche). The British regions are those in which there are sites which NIREX (Nuclear Industry Radioactive Waste Executive) have been investigating with a view to disposing of low and intermediate level radioactive waste. The sites, methods of disposal, cost and radiation levels are detailed for the three countries visited and compared with the NIREX proposals for shallow trench disposal for wastes at low and intermediate levels. The general findings were that the three countries visited are more advanced in the development of policies and practices for radioactive waste disposal with better technical alternatives to the NIREX proposals. Secondly, that the overall cost may be greater than for a shallow repository but would still be less than 1% of the nuclear electricity generation cost. Thirdly, the need to gain and sustain public acceptance for what was being done was more clearly understood and acted on than in the UK. (U.K.).

24157 (INIS-mf—10573, pp 29) **Mobile calcination-cementation unit for solidification of concentrated radioactive wastes.** Napravnk, J.; Sazavsky, P.; Skaba, V. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). 1985. (In Czech). NTIS (US Sales Only), PC A03/MF A01. Order Number DE85701488/JAW. (CONF-8506335—Pt.3).

From Scientific and technical conference on the occasion of the 30th anniversary of the Czechoslovak Nuclear Research Institute; Rez, Czechoslovakia (6 Jun 1985).

In Czech.

24158 **(INIS-mf—11622) Solubility and speciation of actinides in salt solutions and migration experiments of intermediate level waste in salt formations.** (Freie Univ. Berlin (Germany, F.R.). Inst. fuer Anorganische und Analytische Chemie). 1986. 136p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752029/JAW.

A comprehensive study into the solubility of the actinides americium and plutonium in concentrated salt solutions, the release of radionuclides from various forms of conditioned ILW and the migration behaviour of these nuclides through geological material specific to the Gorleben site in Lower Saxony is described. A detailed investigation into the characterization of four highly concentrated salt solutions in terms of their pH, Eh, inorganic carbon contents and their densities is given and a series of experiments investigating the solubility of standard americium(III) and plutonium(IV) hydroxides in these solutions is described. Transuranic mobility studies for solutions derived from the standard hydroxides through salt and sand have shown the presence of at least two types of species present of widely differing mobility; one migrating with approximately the same velocity as the solvent front and the other strongly retarded. Actinide mobility data are presented and discussed for leachates derived from the simulated ILW in cement and data are also presented for the migration of the fission products in leachates derived from real waste solidified in cement and bitumen. Relatively high plutonium mobilities were observed in the case of the former and in the case of the real waste leachates, cesium was found to be the least retarded. The sorption of ruthenium was found to be largely associated with the insoluble residues of the natural rock salt rather than the halite itself.

24159 **(JAERI-M—87-171) In-situ buffer material test, (2). A preliminary test on a bentonite/sand mixture.** Kumata, Masahiro; Shimooka, Kenji; Muraoka, Susumu; Nakamura, Haruto; Nakagoshi, Akio. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 39p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752317/JAW.

Compacted bentonite/sand mixtures are being considered for use as buffer materials, an engineered barrier component of a vitrified high level waste (HLW) package, in the concept for geological disposal of HLW. In order to test thermal characteristics in situ, a heater test with the buffer material was carried out at 40 m depth below surface in granite rock mass. The compacted test material was placed around a electric heater in a test hole, 1 m diameter 5 m depth, and heated about 1800 hours with no groundwater flow into the hole. There was a heat-induced redistribution of the original water content through which partial drying took place close to the heater, while water was accumulated the outside of the dry area. Comparing with the observed temperature distribution and the calculated one which was obtained by FEM-based calculation, it was revealed that the thermal conductivity of the buffer material changed depending on the temperature and moisture during the heater experiment.

24160 **(LBL—24538) Simulation of effects of redox and precipitation on diffusion of uranium solution species in backfill.** Carnahan, C.L. (Lawrence Berkeley Lab., CA (USA)). Dec 1987. Contract AC03-76SF00098. 12p. (CONF-871124—84). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006342/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

This investigation addresses the problem of prediction of the rate of migration of redox-sensitive solution species within packing and backfill materials under conditions of variable oxidation potential. Effects of changes of oxidation potential and precipitation of stable uranium compounds during diffusion of uranium from a region of high oxidation potential into a region of low oxidation potential were simulated numerically. Questions of particular interest addressed in the investigation were the existence of a moving "redox front" and the influence of precipitation-dissolution processes on uranium migration. The simulations showed that no expanding redox fronts existed at any simulated time up to 3.2×10^5 years (10^{13} s). In simulations where precipitation of stable solids was not allowed, variations of oxidation potential did not affect total uranium concentrations in solution. Concentration profiles could be predicted simply by diffusion of the (constant) source concentrations. In simulations where precipitation of stable solids was allowed, uraninite and calcium uranate accumulated at the source-transport domain interface, while coffinite penetrated further into the transport domain. Total uranium concentrations in regions of precipitation were determined by solubilities of the precipitated solids, and were six to seven orders of magnitude lower than those in the simulations without precipitation, throughout the domain of transport. 14 refs., 7 figs., 2 tabs.

24161 **(NUREG—1200-Rev.1) Standard Review Plan for the review of a license application for a low-level radioactive waste disposal facility: Safety analysis report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Jan 1988. 505p. NTIS, PC A22/MF A01 - GPO. Order Number TI88900480/JAW.

The Standard Review Plan (SRP) (NUREG-1200) provides guidance to staff reviewers in the Office of Nuclear Material Safety and Safeguards who perform safety reviews of applications to construct and operate low-level radioactive waste disposal facilities. The SRP ensures the quality and uniformity of the staff reviews and presents a well-defined base from which to evaluate proposed changes in the scope and requirements of the staff reviews. The SRP makes information about the regulatory licensing process widely available and serves to improve the understanding of the staff's review process by interested members of the public and the industry. Each individual SRP addresses the responsibilities of persons performing the review, the matters that are reviewed, the Commission's regulations and acceptance criteria necessary for the

review, how the review is accomplished, the conclusions that are appropriate, and the implementation requirements.

24162 **(NUREG—1297) Peer review for high-level nuclear waste repositories: Generic technical position.** Altman, W.D.; Donnelly, J.P.; Kennedy, J.E. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Nuclear Waste Management). Feb 1988. 29p. NTIS, PC A03/MF A01 - GPO. Order Number TI88900444/JAW.

This document provides guidance on the use of the peer review process in the high-level nuclear waste repository program. The applicant must demonstrate in the license application that the applicable health, safety, and environmental regulations in 10 CFR Part 60 have been met. Confidence in the data used to support the license application is obtained through a quality assurance (AQ) program. Peer reviews may be used as part of the QA actions necessary to provide adequate confidence in the work being reviewed. Because of several unique conditions inherent to the geologic repository program, expert judgment will need to be utilized in assessing the adequacy of work. Peer reviews are a mechanism by which these judgments may be made. This document provides guidance on areas where a peer review is appropriate, the acceptability of peers, and the conduct and documentation of a peer review.

24163 **(ORNL/Sub—87-22274/1) Supercompaction/grouting demonstration project: Final report.** (US Ecology, Inc., Louisville, KY). 1987. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006689/JAW.

The purpose of this supercompaction demonstration project was to allow Martin Marietta Energy Systems, Inc. (The Company), to obtain cost analysis and performance information on volume reduction and waste encapsulation of solid, low-level contaminated waste (SLW). Ultimately, this information will be used to help define a waste disposal process for SLW that is acceptable to regulatory agencies and the US Department of Energy, Oak Ridge Operations (DOE/ORO). The technical objectives of the demonstration project were: (1) to obtain detailed performance data on each of the compacted barrels; (2) evaluate operating performance problems that may have occurred; (3) describe in detail the compaction and encapsulation process; and (4) to obtain operating cost data for the performance of this demonstration.

24164 **(PNL—6351) Field Lysimeter Test Facility for protective barriers: Experimental plan.** Kirkham, R.R.; Gee, G.W.; Downs, J.L. (Pacific Northwest Lab., Richland, WA (USA); Westinghouse Hanford Co., Richland, WA (USA)). Dec 1987. Contract AC06-76RL01830. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005341/JAW.

This document was first written in October 1986 and has been used to guide the design of the Field Lysimeter Test Facility (FLTF) and to promote discussions between research and engineering staff regarding the selection of barrier treatments for inclusion in the FLTF. The construction of the lysimeter facility was completed June 28, 1987. This document describes the facility, the treatments placed in each lysimeter, types of measurements made in each lysimeter, and a brief discussion of project activities related to quality assurance, safety, and funding requirements. The treatment description and figures have been updated to reflect the lysimeter facility as constructed. 12 refs., 6 figs., 5 tabs.

24165 **(PNL—6402) Natural vegetation at the proposed Reference Repository Location in southeastern Washington.** Rickard, W.H. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006136/JAW.

The dominant shrubs were sagebrush and spiny hopsage; the herbs were dominated by cheatgrass and Sandberg bluegrass. Spiny hopsage appeared to be vulnerable to burning and also to damage by off-road vehicular traffic. It appears to have little or no ability to reproduce through seedlings; once the existing plants are killed they are not likely to be replaced, even if seed-producing plants are nearby. The only pure stand of spiny hopsage known to exist on the Hanford Site is on and near study plot 2H. Sagebrush, like spiny hopsage, is killed by burning and by heavy vehicles. Sagebrush is capable of reproducing via seeds, indicating that it is an inherently aggressive species with a capacity to reestablish itself if parent plants are in the vicinity to act as seed sources. Alien, annual plants, especially cheatgrass, were a major contributor to the herbaceous canopy cover in plots 3S, 4S, and 5S. However, native perennial grasses, especially Sandberg bluegrass, were a major contributor to the canopy cover in plots 1S and 2H. These differences are probably caused by differences in soil properties (e.g., water retention capacity), rather than to historical disturbances such as livestock grazing or wildfire. Specimens of Sandwort, Arenaria franklinii, growing near the Reference Repository Location were collected for examination by taxonomists to determine if the specimens are of the variety A. f. thompsonii, a taxon currently listed as threatened in the state of Washington. 16 refs., 7 figs., 3 tabs.

24166 **(PNL—6425) User's guide for West Valley feed preparation code (RECIPE).** Faletti, D.W.; Erb, T.A.; Harty, H.; LoPresti, C.A. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 81p. NTIS, PC E06/MF A01; 1; GPO Dep. Order Number DE88006729/JAW.

The RECIPE code was developed by Pacific Northwest Laboratory under the West Valley Support Task of the Nuclear Waste Treatment Program. Additional chemicals must be added to the high-level wastes to produce an acceptable glass. To maintain the composition of the glass within the targeted compositional region, the chemical additions must be carefully controlled. The amounts and kinds of chemicals that will be required will vary from waste batch to waste batch because the composition and amount of waste will vary among batches, and because the composition of the additives will vary among additive batches. The RECIPE code was developed: to enable accurate computation of the amounts of additives required for a given batch of waste; and to determine whether a batch of slurry will indeed give an acceptable glass composition when mixed with the batch of waste created from the additives. In addition, RECIPE can conduct computations necessary for determining the amount and type of additives required to return an off-specification batch of feed or the melter contents to tolerance levels. This report provides the user with an overview of the glass-making process and RECIPE's role in it, and sufficient information that, when combined with the extensive documentation within the source code, the RECIPE code can be used, maintained, and modified. 3 tabs.

24167 **(PNL—6428) A coupled mechanical-hydrological investigation of crystalline rocks: Annual technical progress report, proposed test matrix, and preliminary results.** Bastian, R.J.; Voss, C.F.; Apted, M.J.; Shotwell, L.R. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 62p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE88006728/JAW.

This report reviews the Fracture Flow Behavior in Rock Study being performed at the Pacific Northwest Laboratory. The study's objective is to determine the feasibility of predicting mechanical-hydrological behavior of natural rock fractures by accurately characterizing fracture surface topography and mineralization. A laboratory-scale facility is currently being used to ensure optimum control of variables. Devising a technique to study small-scale samples is the first step to understanding the complex coupled processes encountered in geomechanics and hydrology. The major accomplishments during fiscal year 1987 were initial development of the innovative testing method, identification of appropriate specimens, substantial renovation to the facility, completion of several sets of experiments, and procurement of hardware components for a laser-imaging device used to characterize fracture surfaces. A complete set of preliminary results and findings is presented in this report. These results, gathered from a basalt core with a natural fracture, have demonstrated that the methodology is valid, and definite trends in the data are readily apparent. 10 refs., 14 figs., 1 tab.

24168 **(PNL—6440) Cold-blooded vertebrates at the proposed Reference Repository Location in southeastern Washington.** Fitzner, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1988. Contract AC06-76RL01830. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006135/JAW.

The information in this interim report will be used to design future environmental monitoring plans and assess impacts related to Basalt Waste Isolation Project (BWIP) activities. New reports will be issued as more data become available. Five study locations were established to study cold-blooded vertebrates in the vicinity of the proposed Reference Repository Location. Four study sites were in shrub-dominated stands of vegetation; the other site was devoid of shrubs because of a range fire in 1984. The side-blotched lizard (Uta stansburiana), trapped in four of the five plots, was the only lizard species captured. It was not trapped in the one plot dominated by spiny hopsage (Grayia spinosa) shrubs. It is uncertain whether the side-blotched lizard is absent from this particular vegetation type, or if the population is too low to have been detected in the relatively short time span of the investigation. Two species of snakes were captured, gopher snakes (Pituophis melanoleucus) and green racers (Coluber constrictor mormon). The number of snakes captured was too small to detect any distributional pattern in space or time. Studies are continuing. 4 refs., 9 figs., 3 tabs.

24169 **(PNL-SA—14720) A comparison of environmental radionuclide concentrations calculated by a mathematical model with measured concentrations.** Jaquish, R.E.; Napier, B.A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 7p. (CONF-8709104—13). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88005121/JAW.

From ANS topical conference on population exposure from nuclear fuel cycle; Oak Ridge, TN, USA (15 Sep 1987).

The Pacific Northwest Laboratory (PNL) conducts an extensive environmental monitoring program at the Hanford Site to determine radioactivity in the environment attributable to Hanford operations and to determine the resulting dose to the population. Monitoring involves the collection and analysis of environmental media including air particulates, water, soil, food crops, wildlife and vegetation. Because the environmental concentrations are so low and in most cases indistinguishable from previously deposited fallout radionuclides, the population doses are calculated using computer dose codes. The model used to calculate accumulated radiation doses from chronic ingestion of food products is incorporated in the PABLM computer code. This code estimates the transfer of radionuclides from air and irrigation water to plants and calculates the resulting concentration of radionuclides in food products. In this study, the concentrations of ^{90}Sr as calculated by PABLM were compared with measured concentrations obtained through the environmental monitoring program to determine how well the computer code predicts the environmental concentrations. 4 refs., 5 tabs.

24170 **(PNL-SA—15425) A comparison of the performance of nuclear waste glasses by modeling.** Grambow, B.; Strachan, D.M. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.); Pacific Northwest Lab., Richland, WA (USA)). Jan 1988. Contract AC06-76RL01830. 13p. (CONF-871124—73). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005897/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

A model selected for the licensing process must be based on a physical and chemical understanding of the glass corrosion mechanism. The purpose of this paper is to show that a dissolution/precipitation model can be used to better understand the effects of various system variables on glass dissolution. The application and validation of this model are also discussed. A dissolution/precipitation model developed appears applicable to experiments with a wide range of solution compositions as well as to more complex systems, such as the bentonite/glass/water system the steel corrosion product/glass/water system, or the dissolution of natural basalt glass in a geologic environment. This model is based on solution chemistry and transition state theory. The theoretical background of this model is discussed elsewhere and is used to describe the dissolution behavior of three nuclear waste glasses. These glasses were selected because they represent a wide range of behavior and, therefore, could be used to illustrate the capabilities of the dissolution/precipitation model. The effects of parameters, such as temperature and starting solution composition, on the dissolution behavior of glass are also discussed. 27 refs., 10 figs., 1 tab.

24171 **(PNL/SRP-SA—15025) Effects of radiation on the oxidation potential of salt brine.** Gray, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 18p. (CONF-871124—83). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005899/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Two different types of experiments have shown that alpha and gamma radiation each increase the redox potential of salt brines. Other experiments have shown that the decrease in potential indicated by platinum electrodes in irradiated brines is due to the response of the electrodes to the hydrogen generated from the resulting water decomposition. Platinum electrodes indicated no change in redox potential of solutions containing equimolar concentrations of $K_3Fe(CN)_6$ and $K_4Fe(CN)_6$ when they were gamma irradiated in quartz containers; when stainless steel containers were used, the solutions reacted with the stainless steel but gamma radiation had no significant effect on that reaction or the solution composition. A gamma radiation dose rate of 2.4×10^4 rad/h measurably increased the uniform corrosion rate of mild steel in salt brines at 75°C, but at 150°C the increased thermal corrosion rate obscured any effect of even higher gamma radiation dose rates. 7 refs., 4 figs., 4 tabs.

24172 **(PNL/SRP-SA—15413) Corrosion studies of A216 grade WCA steel in hydrothermal magnesium-containing brines.** Haberman, J.H.; Frydrych, D.J. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 13p. (CONF-8711100—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005898/JAW.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (30 Nov 1987).

The US Department of Energy's Salt Repository Project (SRP) is investigating the general corrosion resistance of cast mild steel as a candidate material for waste package containers. Evaluation of this material is being performed at the Pacific Northwest Laboratory in environments simulating expected repository conditions. General corrosion studies of mild steel (ASTM A216 grade WCA) in the as-cast and normalized conditions were conducted in hydrothermal halite-saturated (saturated at ambient temperature) brine environments simulating a "dissolution" and an "inclusion" brine. Corrosion tests were also performed in brines similar to the inclusion brine but containing magnesium concentrations ranging from 1000 to 30,000 ppM to investigate the effect of magnesium on the corrosion behavior. Corrosion rates of the cast mild steel were found to increase with increasing temperature and with increasing magnesium concentration. Some possible mechanisms that explain the observed behavior are presented. 8 refs., 7 figs., 2 tabs.

24173 **(PNL/SRP-SA—15431) Modeling the dissolution behavior of defense waste glass in a salt repository environment.** McGrain, B.P. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 15p. (CONF-871124—90). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005883/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

A mechanistic model describing a dynamic mass balance between the production and consumption of dissolved silica was found to describe the dissolution behavior of SRL-165 defense waste glass in a high-magnesium brine (PBB3) at a temperature of 90°C. The synergistic effect of the waste package container on the glass dissolution rate was found to depend on a precipitation reaction for a ferrous silicate mineral. The model predicted that the ferrous silicate precipitate should be variable in composition where the iron/silica stoichiometry depended on the metal/glass surface area ratio used in the experiment. This prediction was confirmed experimentally by the variable iron/silica ratios observed in filtered leachates. However, the interaction between dissolved silica and iron

corrosion products needs to be much better understood before the model can be used with confidence in predicting radionuclide release rates for a salt repository. 25 refs., 4 figs., 1 tab.

24174 **(PTB-SE—16) Requirements for radioactive waste for final storage (preliminary final storage conditions, as of November 1986) - Konrad shaft.** Brennecke, P.; Warnecke, E. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle). Jan 1987. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752678/JAW.

In order to prove the safety of the planned Konrad final store during the operating and post-operational phase, safety analyses were carried out. The results are given in the present draft. The requirements must be fulfilled according to the present state at the Konrad final store according to tests by the appropriate planning authority when delivering waste containers. Because of the outstanding test in the context of the planning process, they are described as preliminary final storage conditions. Other requirements for the waste containers to be stored may arise from the planning authorities demands. The final storage conditions are finally decided by the planning decision.

24175 **(SAND—87-2358C) Behavior of a simulated, metal spent-fuel storage cask under explosive attack.** Philbin, J.S.; Emerson, E.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-880201—15). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006276/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

Experimental data and calculations to define the potential hazard from a hostile attack upon a metal spent-fuel cask utilized for on-site, above-ground storage are presented. A high energy device (HED) was directed at a simulated section (test article) of a large, dry storage cask for on-site storage of 5-y or older spent fuel. The test article consisted of steel plates, representing the metal storage cask wall, followed by nine compartments containing "depleted" fuel rod assemblies. The test article configuration was representative of the basket/fuel arrangement found in the cavity of a full-size storage cask. The explosive device caused penetration through five of the nine fuel assembly compartments, producing progressively smaller holes and damage as it proceeded into the test article. The total mass of UO_2 displaced (i.e., removed from the clad/rod geometry) by the penetration was 12.9 kg. Of this total, 2.03 kg of the UO_2 was expelled from the test article to an area defined by a 4.6 m (15 ft) radius from the front of the test article. This represents a possible upper limit for the amount of material that can be ejected from a real cask as a result of such an attack. Using a previously developed release fraction (i.e., respirable mass released/total mass displaced), the mass of fuel aerosolized and released from a cask for this type of incident is on the order of 6.5 g. The predicted downwind whole body and lung doses from such a release are 1.0 and 2.0 rem (at 100 m) and 0.10 and 0.2 rem (at 1000 m), respectively. 13 refs., 1 fig., 3 tabs.

24176 **(SCSIN—U-1-2-84) Safety objectives and basic design for surface centres for long-term storage of solid radioactive waste with short or medium half-life and low or medium specific activity.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Jun 1984. 27p. (SIN—3210-84). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752205/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The role of this RFS is to define the safety objectives and the basic design philosophy for surface centres for long-term storage of packages of radioactive waste with short or medium half-life and with low or medium specific activity.

24177 **(SCSIN—U-3-2-E-86) Previous conditions for agreement of solid radioactive wastes packaged for ground storage.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Oct 1986. 29p. (In French). (SIN—3948-86). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752180/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analyses and the clear understanding between persons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem this necessary, while specifying the applicability conditions. This present rule has for objective to specify the conditions judged necessaries by the Central Service for the Safety of Nuclear Installations, before agreement by the National Agency for management of radioactive wastes (ANDRA) for ground disposal wastes. This rule completes, the basic safety rule I.2 revision 1, under date of the 19 june 1984.

24178 **(SKB-TR—86-21) Steady-state flow in a rock mass intersected by permeable fracture zones. Calculations on case 2 within the GWHRT-code with level 1 of the HYDROCOIN project.** Lindbom, B. (KEMAKTA Consultants Co., Stockholm (Sweden)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1986. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752711/JAW.

Level 1 of HYDROCOIN consists of seven well-defined test problems. This paper is concerned with Case 2, which is formulated as a generic groundwater flow situation often found in crystalline rock with highly permeable fracture zones in a less permeable rock mass. The case is two-dimensional and modelled with 8-noded, isoparametric, rectangular elements. According to the case definition, calculations of hydraulic head and particle tracking are performed. The computations are carried out with varying degree of discretisation in order to analyse possible impact on the result with respect to nodal density. Further calculations have been performed mainly devoted to mass balance deviations and how these are affected by permeability contrasts, varying degree of spatial discretisation and distortion of finite elements. The distribution of hydraulic head in the domain is less sensitive to differences in nodal density than the trajectories. The hydraulic heads show similar behaviour for three meshes with varying degrees of discretisation. The particle tracking seems to be more sensitive to the level of discretisation. The results obtained with a coarse and medium mesh indicate completely different solutions for one of the pathlines. The coarse mesh is too sparsely discretised for the specified problem. The local mass balance is evaluated for seven runs. The mass balance deviation seems to be considerably more sensitive to the level of discretisation than to both permeability contrasts and deformation of elements. The permeability contrasts between the rock mass and fracture zones vary from a factor of 1000 to 1 (homogeneous properties) with increments of a factor of 10. These calculations in fact give better mass balance with increasing permeability contrasts, contrary to what could be expected.

24179 (SKB-TR—87-09) Piping and erosion phenomena in soft clay gels. Pusch, R.; Erlstroem, M.; Boergesson, L. (Sveriges Geologiska Undersoekning, Uppsala). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Sveriges Geologiska Undersoekning, Uppsala). May 1987. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752717/JAW.

The present study has confirmed the conclusions from earlier investigations of piping and erosion of soft smectite gels by showing that the erodibility can be predicted by comparing the drag forces exerted by flowing water and the cohesive particle bonds in the gels. Optical microscopy used to identify the detailed erosion mechanisms shows that discrete flakes are not eroded as assumed earlier. The minerals torn off from the gels in fact consist of stable aggregates sized 5-50 μm in the case of electrolyte-poor water and even larger units in ocean-type water. The theoretical model as well as the experiments show that erosion is initiated at a flow rate of 10/sup -4/ m/s in the first-mentioned type of water and that it becomes significant at 10/sup -3/m/s. In salt water the gels are much more erosion-resistant. Piping, which preceded the erosion in the tests, can take place in the form of radial expansion of natural pore passages in the gels, or by tensile failure, depending on the boundary conditions. Theoretically, the critical pressure to produce piping is about 1 kPa at water content of 1000% of Na montmorillonite and this appeared to be on the same order of magnitude as the experimentally determined values for the very conservative conditions that were applied. Separate tests of a clay rich in hydrous mica showed much less erodibility and higher piping resistance than of the smectite gels.

24180 (WHC-EP—0089-1) Basalt Waste Isolation Project documents/data accessions list: Quarterly report, June 25-September 25, 1987. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1987. Contract AC06-87RL10930. 570p. NTIS, PC A24/MF A01; 1; GPO Dep. Order Number DE88004966/JAW.

This publication contains a listing of documents published by and for the Basalt Waste Isolation Project (BWIP). These documents have been approved for release to the Program Participants for use in monitoring and participating in the BWIP characterization and design process in accordance with the Nuclear Waste Policy Act of 1982, in cooperation with the US Department of Energy (USDOE) and Westinghouse Hanford Company of Richland, Washington. Program participants include the Nuclear Regulatory Commission, affected Indian Tribes, the States of Washington and Oregon, the US Geological Survey and others, as directed by the USDOE.

24181 Electrochemical processing of low-level waste solutions. Hobbs, D.T.; Ebra, M.A. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC 29808). pp 161-166 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC09-76SR00001.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The feasibility of treating low-level Savannah River Plant (SRP) waste solutions by an electrolytic process has been demonstrated. Although the economics of the process are marginal at the current densities investigated at the laboratory scale, there are a number of positive environmental benefits. These benefits include: 1) reduction in the levels of nitrate and nitrite in the waste, 2) further decontamination of Tc-99 and Ru-106 and 3) reduction in the volume of waste.

24182 Effect of process variables on the removal of contaminants from radioactive waste streams using zeolites. Grant, D.C.; Skriba, M.C.; Saha, A.K.; Ploetz, D.K. (Chemical and Process Engineering, Westinghouse R and D Center, Pittsburgh, PA 15235). pp 609-612 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A variety of low level radioactive waste streams are being generated from the decontamination and decommissioning of the former nuclear fuel reprocessing plant at West Valley, New York. The radioactive contaminants from these wastes will be removed and concentrated using zeolites. A study was conducted using representative waste streams to evaluate and compare various zeolites and to provide operating data for the ion exchange process. The testing showed that the contaminant removal was strongly dependent upon waste composition and residence time. Even seemingly slight variations in waste composition resulted in significantly different contaminant loading characteristics. It was found that to obtain the desired cesium and strontium decontamination factors for the waste streams of interest, mixtures of zeolites (i.e. phillipsite and Union Carbide's A-51) had to be used. The required residence time is found to be 20 to 40 minutes depending on the waste stream. The testing also indicated that thousands of bed volumes of the waste solutions could be processed under the required conditions before any significant contaminant breakthrough occurred.

24183 Cleanup operations at the Oak Ridge Gaseous Diffusion Plant contaminated metal scrapyard. Williams, L.C. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 443-452 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC05-84OR21400.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Cleanup operations at the contaminated metal storage yard located at the Oak Ridge, Tennessee, Gaseous Diffusion Plant have been completed. The storage yard, in existence since the early 1970's, contained an estimated 35,000 tons of mixed-type metals spread over an area of roughly 30 acres. The overall cleanup program required removing the metal from the storage yard, sorting by specific metal types, and size reduction of specific types for future processing. This paper explains the methods and procedures used to accomplish this task.

24184 Waste-acceptance criteria for radioactive waste disposal. Gilbert, T.L.; Meshkov, N.K. (Energy and Environmental Systems Div., Argonne National Lab., Argonne, IL 60439). pp 297-304 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract W-31-109-ENG-38.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A method has been developed for establishing waste-acceptance criteria based on quantitative performance factors that characterize the confinement capabilities of a disposal facility for radioactive waste. The method starts from the basic objective of protecting public health and safety by assuring that disposal of the waste will not result in a radiation dose to any member of the general public, in either the short or long term, in excess of an established basic dose limit. A key aspect of the method is the introduction of a confinement factor that characterizes the overall confinement capability of a particular disposal facility and can be used for quantitative performance assessments as well as for establishing facility-specific waste-acceptance criteria. Confinement factors enable direct and simple conversion of a basic dose limit into waste-acceptance criteria, specified as concentration limits on radionuclides in the waste streams. Waste-acceptance criteria can be represented visually as activity/time plots for various waste streams. These plots show the concentrations of radionuclides in a waste stream as a function of time and permit a visual, quantitative assessment of long-term performance, relative risks from different radionuclides in the waste stream, and contributions from ingrowth. Application of the method to generic facility designs provides a rational basis for a waste classification system.

24185 **Use of systems analysis techniques in the EG and G Idaho Waste Management Environmental Surveillance Program.** Case, M.J.; Ritter, P.D. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID 83415). pp 357-362 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC07-76ID01570.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The Environmental Surveillance Program of EG&G Idaho, Inc., has successfully implemented a systems analysis approach, using simulation models to supplement its monitoring program at the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory. Systems analysis has been used to attain several program objectives including environmental and performance assessments of buried radioactive waste, design and modification of the monitoring program, and support to operations personnel in revising operations to reduce RWMC impacts and in formulating closure designs. This endeavor has also provided an avenue for cooperative interaction between modeling, monitoring, and waste management operations. A description of the approach and models used are presented in this paper.

24186 **The development of a site characterization field manual for near surface geologic disposal of low-level nuclear waste (LLNW).** Nowatzki, E.A.; McCray, J.G. (The Univ. of Arizona, Dept. of Civil Engineering and Engineering Mechanics, Tucson, AZ 85721). pp 391-396 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A manual was recently (1985) developed at The University of Arizona to aid government agencies in formulating a program for the detailed characterization of a proposed near-surface, low-level nuclear waste (LLNW) disposal site. Included in the manual are specific procedures for site characterization management, identification of pertinent technical parameters and methods for their determination, and the development of general procedures for conducting a site characterization study. This paper describes the general make up of the manual and presents an example of site characterization with respect to geotechnical engineering parameters. A brief description is also given of a general procedure for site characterization that can be used by planners, managers, and staff personnel to implement the process of evaluating the suitability of a site for LLNW disposal.

24187 **New low-level radioactive waste storage/disposal facilities for the Savannah River Plant.** Cook, J.R. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC 29808). pp 411-414 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC09-76SR00001.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Within the next few years the Savannah River Plant will require new facilities for the disposal and/or storage of solid low-level radioactive waste. Six options have been developed which would meet the regulatory and site-specific requirements for such facilities.

24188 **Modeling of low-level-waste disposal for environmental impact analysis.** Yu, C. (Energy and Environmental Systems Div., Argonne National Lab., Argonne, IL 60439). pp 385-390 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A computer model was developed to analyze environmental impacts resulting from disposal of both radioactive and chemical wastes. The model simulates a waste-disposal system and includes infiltration through disposal cell caps, source leach rates, and solute transport in geologic media. The solute transport model used is a modified version of an analytical code originally developed at Oak Ridge National Laboratory (ORNL). The solute transport code was modified based on the Group-Transfer Concentration (GTC) concept developed by the author. The original ORNL mode is applicable only to homogeneous media under saturated conditions, but the modified model extends applicability to nonhomogeneous media (layered soils and fractures) and partially saturated conditions. The modified model has broader applicability, e.g., it can be applied to both humid and arid waste-disposal sites, and it is also more practical for environmental impact analysis.

24189 **Laboratory performance testing of an extruded bitumen containing a surrogate, sodium nitrate-based, low-level aqueous waste.** Mattus, A.J.; Kaczmarsky, M.M. (Martin Marietta Energy Systems, Inc., P.O. Box P, Oak Ridge, TN 37831 (USA)). pp 517-524 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Laboratory results of a comprehensive regulatory performance test program, using an extruded bitumen and a surrogate, sodium nitrate-based waste, have been compiled at the Oak Ridge National Laboratory (ORNL). The testing has shown that the relatively viscous form of oxidized bitumen that was used has been able to meet all performance requirements. Using a 53-mm Werner and Pfleiderer extruder, operated by personnel of WasteChem Corporation of Paramus, New Jersey, laboratory-scale, molded samples of ASTM D312, type III, air-blown bitumen were prepared for laboratory performance testing. A surrogate, low-level, mixed liquid waste, formulated to represent an actual on-site waste at ORNL, was used. The mixed liquid waste contained approximately 30 wt % sodium nitrate, in addition to eight heavy metals, cold cesium, and strontium. Samples tested contained three levels of waste loading: that is, 40, 50, and 60 wt % salt. Performance test results include the 90-day American Nuclear Society (ANS) 16.1 leach test, with leach indices reported for all cations and anions, in addition to the EP toxicity test, at all levels of waste loading. Additionally, test results presented include the unconfined compressive strength and surface morphology utilizing scanning electron microscopy (SEM). Data presented include correlations between waste form loading and test results, in addition to their relationship to regulatory performance requirements.

24190 **New treatment facility for low level process effluents at the Savannah River site.** Ebra, M.A.; Bibler, J.P.; Johnston, B.S.; Kilpatrick, L.L.; Poy, F.L.; Wallace, R.M. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC 29808 (USA)). pp 747-750 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC09-76SR00001.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A new facility, the F/H Effluent Treatment Facility (F/H ETF) is under construction at the Savannah River site. It will decontaminate process effluents containing low levels of radionuclides and hazardous chemicals prior to discharge to a surface stream. These effluents, which are currently discharged to seepage basins, originate in the chemical separations and high level radioactive waste processing areas, known as F-Area and H-Area. The new facility will allow closure of the basins in order to meet the provisions of the Resource Conservation and Recovery Act by November 1988. A high degree of reliability is expected from this design as a result of extensive process development work that has been conducted at the Savannah River Laboratory. This work has included both bench scale testing of individual unit operations and pilot scale testing of an integrated facility, 150-285 L/min (40-75 gpm), that contains the major operations.

24191 **Evaluation of potential mixed wastes containing lead, chromium, or used oil.** Siskind, B.; MacKenzie, D.R.; Bowerman, B.S.; Kempf, C.R.; Piciulo, P.L. (Dept. of Nuclear Energy, Brookhaven National Lab., Upton, NY 11973 (USA)). pp 375-384 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

This paper presents the results of follow-on studies conducted by Brookhaven National Laboratory (BNL) for the Nuclear Regulatory Commission (NRC) on certain kinds of low-level waste (LLW) which could also be classified as hazardous waste subject to regulation by the Environmental Protection Agency (EPA). Such LLW is termed "mixed waste." Additional data have been collected and evaluated on two categories of potential mixed waste, namely LLW containing metallic lead and LLW containing chromium. Additionally, LLW with organic liquids, especially liquid scintillation wastes, are reviewed. In light of a proposed EPA rule to list used oil as hazardous waste, the potential mixed waste hazard of used oil contaminated with radionuclides is discussed. It is concluded that the EPA test for determining whether a solid waste exhibits the hazardous characteristic of extraction procedure toxicity does not adequately simulate the burial environment at LLW disposal sites, and in particular, does not adequately assess the potential for dissolution and transport of buried metallic lead. Also, although chromates are, in general, not a normal or routine constituent in commercial LLW (with the possible exception of chemical decontamination wastes), light water reactors which do use chromates might find it beneficial to consider alternative corrosion inhibitors. In addition, it is noted that if used oil is listed by the EPA as hazardous waste, LLW oil may be managed by a scheme including one or more of the following processes: incineration, immobilization, sorption, aqueous extraction and glass furnace processing.

24192 **Stability of low-level cement-based waste systems.** Malek, R.I.A.; Roy, D.M. (Materials Research Lab., The Pennsylvania State Univ., University Park, PA 16802 (USA)). pp 363-368 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A low temperature hydrated ceramic waste form has been designed for solidification and stabilization of low-level radioactive waste. The suggested waste forms were based mainly on cementitious materials. A solution composed of 2.5M NaNO/sub 3/, 0.8M NaNO/sub 2/ and 1.2M NaOH was used as a waste solution. This represents both the high alkalinity and high nitrate/nitrite contents of many LLW solutions. The high alkalinity of the waste solution made it possible to blend some by-product materials (e.g, ground granulated blast-furnace slag and fly ashes) with minimum amounts of cement to obtain a lightweight, low density waste form of economic value and excellent processibility. The chemical environment created by mixing this LLW solution with cementitious materials will affect the stability and long-term performance of the waste form. In addition, the information gained from studying such an environment will certainly help attaining best performance. For such purposes, the Eh and pH of the pore fluids expressed from hydrating waste forms were measured. The measured values were located on various Eh-pH diagrams to find the stability/instability regions for compounds of major concern. Furthermore, the dimensional and thermal stabilities of the hardened waste forms were determined by measuring expansive stresses, and lengths changes as a function of time and heat cycle. The effects produced by such findings on long-term durability of the waste forms are discussed.

24193 **Characterization of INEL compactible low-level wastes and evaluation of compactor options.** Gillins, R.L.; Larsen, M.M. (Idaho National Engineering Lab., EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415 (USA)). pp 623-630 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC07-76ID01570.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The volume reduction of solid low-level waste (LLW) generated at the Idaho National Engineering Laboratory (INEL) has been high priority in recent years, due to the dwindling volume of available burial space. Volume reduction by incineration, plasma arc cutting, and melting have been reported previously and have had a dramatic effect on the volume of LLW disposed of at the INEL's Radioactive Waste Management Complex. The remaining LLW streams not eligible for these processes were characterized to determine the volume which may be reduced by compaction in a variety of compactor types. Various compactor options were investigated to determine the configuration best suited to the needs of the INEL. The study results in recommendations for pursuing an expanded LLW compaction program at the INEL.

24194 **A survey of low-level radioactive waste treatment methods and problem areas associated with commercial nuclear power plants.** Jolley, R.L.; Rodgers, B.R. (Oak Ridge National Lab., Oak Ridge, TN 37831 (USA)). pp 675-680 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC05-84OR21400.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A survey was made (June 1985) of technologies that were currently being used, those that had been discontinued, and those that were under consideration for treatment of low-level radioactive waste from the commercial nuclear power plants in the United States. The survey results included information concerning problems areas, areas needing research and development, and the use of mobile treatment facilities.

24195 **Regional LLRW processing alternatives applying the DOE REGINALT systems analysis model.** Beers, G.H. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID 83415 (USA)). pp 39-46 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC07-76ID01570.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The DOE Low-Level Waste Management Program has developed a computer-based decision support system of models that may be used by nonprogrammers to evaluate a comprehensive approach to commercial low-level radioactive waste (LLRW) management. REGINALT (Regional Waste Management Alternatives Analysis Model) implementation will be described as the model is applied to hypothetical regional compact for the purpose of examining the technical and economic potential of two waste processing alternatives. Using waste from a typical regional compact, two specific regional waste processing centers are compared for feasibility. Example 1 assumes that a regional supercompaction facility is being developed for the region. Example 2 assumes that a regional facility with both supercompaction and incineration is specified. Both examples include identical disposal facilities, except that capacity may differ due to variation in volume reduction achieved. The two examples are compared with regard to volume reduction achieved, estimated occupational exposure for the processing facilities, and life cycle costs per generated unit waste. A base case also illustrates current disposal practices. The results of the comparisons evaluated, and other steps, if necessary, for additional decision support are identified.

24196 Modeling multiphase heat and mass transfer in consolidated, fractured, porous media. Bixler, N.E.; Eaton, R.R. (Fluid and Thermal Sciences Dept., Sandia National Labs., Albuquerque, NM 87185 (USA)). pp 1 of Proceedings of the 4th Miami international symposium on multiphase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

A number of potential transport mechanisms are considered in this paper: Darcy flow due to pressure and density gradients in the liquid and gas phases; Knudsen diffusion in the gas phase; binary diffusion in the gas phase; heat conduction; energy convection; and evaporation/condensation and its associated latent heat effects. Most of these mechanisms are highly nonlinear, especially Darcy flow, where relative permeabilities often vary by orders of magnitude depending on local saturation, and evaporation/condensation, which depends strongly on local temperature, gas pressure, and saturation. As a consequence of the nonlinearities, it is essential to employ numerical methods if realistic modeling is to be performed. Here, the numerical model is of the standard Galerkin/finite element variety, which is convenient for handling irregular domains and a wide variety of boundary conditions. This numerical model is used to examine the relative effectiveness of each of the transport mechanisms in several one-dimensional and simple two-dimensional multiphase flows in fractured and unfractured porous materials. The importance of fracture orientation is also studied. Predictions are compared with experimental measurements for imbibition and drying of fractured volcanic tuff.

24197 The Uranium Mill Tailings Remedial Actions project: A progress report on DOE's cleanup program. Matthews, M.L. (U.S. Dept. of Energy, Albuquerque Operations Office, Albuquerque, NM 87115 (USA)). pp 151-156 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

In late 1978, Congress enacted Public Law 95-604, the "Uranium Mill Tailings Radiation Control Act of 1978." Title I of the Act instructed the Department of Energy to perform remedial actions at designed inactive uranium mill tailings sites. The Department established the Uranium Mill Tailings Remedial Actions (UMTRA) Project Office to implement remedial actions at twenty-four (24) sites, in cooperation with the affected States, Indian tribes, Nuclear Regulatory Commission, and owners of the sites. The UMTRA Project Office began remedial actions at the first site in 1983, and all sites are planned to be cleaned up by 1993. Numerous vicinity properties located near the designated sites are also undergoing remedial actions. All of this work is being performed in accordance with Environmental Protection Agency cleanup standards.

24198 Quality assurance consideration for cement-based grout technology programs at Oak Ridge National Laboratory. McDaniel, E.W.; Sams, T.L.; Delzer, D.B.; Tallent, O.K. (Oak Ridge National Lab., Oak Ridge, TN 37831 (USA)). pp 103-106 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC05-84OR21400.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The Oak Ridge National Laboratory (ORNL) has developed and is continuing to refine a method for immobilizing low-level radioactive liquid wastes by mixing them with cementitious dry-solid blends. Currently, ORNL is investigating a grouting facility that will pump a liquid grout/waste mixture to a disposal site where the mixture will harden in situ, forming a grout monolith. A quality assurance (QA) program is vital to the project because Nuclear Regulatory Commission (NRC), Environmental Protection Agency (EPA), and state environmental regulations must be demonstrably met; that is, the work must be defensible in a court of law. The end result of QA is, by definition, a product of demonstrable quality. In the laboratory, this entails traceability, repeatability, and credibility. This paper describes the application of QA in grout technology development at ORNL.

24199 Managing greater-than-Class-C low-level waste. Smiley, J.L.; Knecht, M.A.; Dressen, A.L.; Serie, P.J. (U.S. Dept. of Energy, Washington, DC (USA)). pp 317-322 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC07-76ID01570.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Congress has assigned to the Federal Government responsibility to safely dispose of a category of nonDOE low-level radioactive waste classified as "greater-than-Class-C that results from activities licensed by the NRC." Concentrations of radionuclides in this waste exceed the Nuclear Regulatory Commisision (NRC) limits for routine near-surface disposal. A recent Department of Energy (DOE) report to Congress identified the wastes that are in this category, defined issues that must be resolved to safely manage the waste, and proposed an approach to implement the federal responsibility. The volume of this waste is relatively small, but its management presents some unique needs. Those include a clear definition of the waste, improved data on volumes and characteristics of the waste, additional regulatory guidance from NRC and the Environmental Protection Agency, and an assessment of the viability of disposal at nonfederal sites. When these needs have been met, disposal capacity can be developed that will ensure the safe disposal of all waste in this category. In the interim, DOE proposes to explore nonfederal disposal options and, if necessary, accept the waste upon request of the generators, take title to the waste, store it until disposal capacity is available, and ensure its safe disposal with all reasonable costs to be borne by the waste generator or owner.

24200 Nonchemical decontamination techniques. Allen, R.P. (Battelle, Pacific Northwest Labs., Richland, WA). *Nuclear News (La Grange Park, Illinois);* 112-116(Jun 1985).

The decontamination techniques summarized in this article represent a variety of surface cleaning methods developed or adapted for component and facility-type decontamination applications ranging from small hand tools to reactor cavities and other large surface areas. Representative nonchemical decontamination techniques include: ultrasonics, abrasive cleaning, high-pressure Freon cleaning, and vibratory finishing.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 24139, 24140, 24141, 24142, 24147, 24158, 24160, 24164, 24167, 24169, 24171, 24172, 24173, 24181, 24185, 24198, 24203, 25035, 25062, 25087

24201 (DOE/ID—10087(86)) Effluent Information System (EIS) / Onsite Discharge Information System (ODIS): 1986 executive summary. Watanabe, T. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1987. Contract AC07-76ID01570. 121p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88005643/JAW.

Department of Energy (DOE) data base systems aid DOE-Headquarters and Field Offices in managing the radioactive air and liquid effluents from DOE facilities. Data on effluents released offsite are entered into effluent information system (EIS) and data on effluents discharged onsite and retained onsite are entered into Onsite Discharge Information System (ODIS). This document is a summary of information obtained from the CY 1986 effluent data received from all DOE and DOE contractor facilities and entered in the data bases. Data from previous years are also included. The summary consists of information for effluents released offsite, and information for effluents retained onsite.

0540 Health And Safety

REFER ALSO TO CITATION(S) 24147, 24184, 24191, 24470

24202 **(CONF-860293—) Proceedings of the information meeting on meteorological requirements for emergency response and assessment activities at DOE sites.** Moses, H. (ed.). (USDOE Office of Energy Research, Washington, DC. Office of Health and Environmental Research). Dec 1987. 205p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88005081/JAW.

From DOE information meeting on meteorological requirements for emergency response and assessment at DOE sites; Oak Ridge, TN, USA (25 Feb 1986).

This report consists of a selection of 12 papers given at an information meeting on Meteorological Requirements for Emergency Response and Assessments Activities at Department of Energy Sites. One may classify the papers into five categories: The first of these deals with emergency response procedures at Pacific Northwest Laboratory, Rocky Flats, Savannah River Laboratory, and the Nevada Test Site. Each of the sites is quite different and the special features are discussed. Special tasks involved in emergency response are presented next. The third category deals with models for use in Emergency Response Procedures. A paper presented at the 73rd Indian Science Congress Symposium, New Delhi, India, is included since its content discusses the use of different types of models in emergency response procedures, which ties in quite well with the objectives of the Conference. The dispersion of special materials particularly those heavier than air is discussed in the fourth group. The important influence of neighboring buildings on the near-field dispersion is shown on the behavior of effluents near building.

24203 **(CONF-880201—16) Regulatory and institutional issues for development of remedial action strategies at ORNL.** Kocher, D.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006414/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

This paper discusses a number of unresolved regulatory and institutional issues of fundamental importance to the development of strategies for cleanup of sites contaminated by the radioactive materials at Oak Ridge National Laboratory. These issues include the development of criteria for limiting radiation exposures of the public from remedial action sites, the time period to be assumed for active institutional controls over contaminated sites and the location at which such controls will be maintained, and the applicability of current standards for radioactivity in drinking water to surface waters and ground waters on the Oak Ridge Reservation. Proposals for resolution of these issues emphasize the need to protect public health, but in a cost-effective manner. 21 refs.

24204 **(RFP—4154) Ventilating-air change rate versus particulate contaminant spread.** Langer, G.; Deitesfeld, C.A. (ed.). (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 13 Nov 1987. Contract AC04-76DP03533. 18p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006977/JAW.

This study provides information on the spread of particulate contamination from glovebox leaks in plutonium manufacturing facilities, with emphasis on the effect of ventilating-air change rate on contaminated spread. A new, very sensitive aerosol tracer technique was developed to simulate plutonium aerosol leaks and its dispersion in a room. The tracer, a submicron aerosol of phloroglucinol, does not interfere with work activity and is detected by its ability to form ice crystals in a supercooled cloud. This technique was applied in Buildings 371 and 707 plutonium production areas. The tracer spread throughout the rooms in a few minutes and reached its equilibrium concentration in 10 to 25 min. Also, to clear the room of all tracer took about the same time. In one room, tracer concentration decreased proportionally to the air change rate, while in the second one, air change rate had no effect. This points out the need for air velocity data. Also, future work must include simultaneous particle concentration measurements at several points. 4 refs., 9 figs., 2 tabs.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 24161, 24184, 24186, 24187, 24194, 24195, 24198, 24431, 24434

24205 **(DP-MS—87-142-Del.Ver.) Design of a study of Systems Analysis for Material Control and Accountancy Technology (SAMCAT).** Persiani, P.J.; Rothman, A.B.; Bucher, R.G.; Daly, T.A.; Cha, B.C.; Trevorrow, L.E.; Seefeldt, W.B.; Stewart, W.E. (Argonne National Lab., IL (USA); Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1987. Contract AC09-76SR00001. 12p. (CONF-871110—5-Del.Ver.). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005586/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

The Systems Analysis for Material Control and Accountancy Technology (SAMCAT) is a program to develop an interactive computer-based management system for decision support in evaluating Material Control and Accountancy (MC&A) upgrades and for validating the MC&A aspects of the Master Safeguards and Security Agreements (MSSA) effectiveness. This paper briefly reviews SAMCAT and presents the status of current activities, with primary focus on the design of a pilot study that has been planned for the near-term development program. The objective of the pilot study is to aid in the development and testing of assessment technologies by utilizing data and information from recent upgrades in MC&A measurements at several of the measurement locations that were important contributors to the uncertainty of the inventory differences (IDs) for a specific material balance area (MBA). The FB-Line MBA in the plutonium production cycle through Savannah River was recommended as a candidate MBA for the study. Attributes considered as selection criteria of key measurement locations for MC&A upgrades, importance rankings of the measurement locations, modeling approaches in evaluating the effectiveness of upgrades at given locations, and the data requirements to support the pilot study are presented. Applications of the near-term pilot study to the overall SAMCAT development program are also presented. 2 refs., 3 figs., 1 tab.

24206 (KFK—4223, pp 141-155) **Monitoring systems in waste treatment.** Weidemann, R.; Kerpe, R.; Jaeschke, A. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Datenverarbeitung in der Technik). Mar 1987. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88752262/JAW. (CONF-8609392—).

From Colloquium on applications of information technology in the environmental area; Karlsruhe, F.R. Germany (30 Sep 1986).

Monitoring systems in waste treatment are basically material follow-up systems or are at least based on such systems. They cover the areas of the generation, transport, treatment, intermediate storage and depositing waste. The procedure in the design and construction of such systems is shown from the monitoring systems for nuclear material (system K2) and for radioactive residues (KADABRA system) and a transferable concept which can be adapted for conventional waste for monitoring material follow-up and balancing. The advantages of a solution which integrates the firm's and official monitoring and experience in processing and storage of radioactive residues and wastes in the main Decontamination Department at KfK are discussed.

24207 **(KFK—4326) GEMUF test and issues to the near-real-time-accountancy.** Seifert, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Datenverarbeitung in der Technik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Nov 1987. 78p. (In German). (PWA—60/87). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752675/JAW.

This paper presents a new sequential test procedure, called GEMUF test, to detect a loss of material in a sequence of accounting periods. The GEMUF test is based on the theoretically best possible, but in practice inapplicable, Neyman-Pearson tests. The

idea of the GEMUF test is to estimate the unknown loss pattern by a weighted sum of MUF values. The numerical results are obtained by Monte Carlo simulations for a reference reprocessing facility with a throughput of 1000 t of heavy metal per year. They demonstrate in comparison with other sequential test procedures that this new test gives results for all considered loss patterns that are very close to the best possible results of the Neyman-Pearson tests, i.e. the GEMUF test is 'robust' to various loss patterns. The investigations show also that the GEMUF test is very 'sensitive' by virtue of its short detection time.

24208 **(SAND—88-0165C) Security controls in a Cullinet database environment.** Thompson, R.E. (Sandia National Labs., Albuquerque, NM (USA)). 3 Mar 1988. Contract AC04-76DP00789. 32p. (CONF-880349—1-Vugraphs). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006277/JAW.

From Cullinet Federal Advisory Group conference; Washington, DC, USA (2 Mar 1988).

Security controls using Cullinet's Integrated Data Management System (IDMS) are examined. IDMS software integrity problems, with emphasis on security package interfaces, are disclosed. Solutions applied at Sandia Laboratories Engineering Information Management computing facilty are presented. An overall IDMS computer security philosophy is reviewed.

24209 **(SAND—88-0180) Coded credentials: A primer.** Wright, L.J. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1988. Contract AC04-76DP00789. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006931/JAW.

The need to identify people is an age-old requirement that has taken many forms over the ages. With the advent of the age of technology, the need has become more acute and many methods have been devised to help with the identification process. This report is designed to be a primer on one of those methods - the coded credential, e.g., a credential that is compatible with computerized access control systems.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 24162, 24186, 24190, 24197, 24198, 24199, 24203

24210 **(INFO—0120) Assessment for medico-legal purposes of the contribution of occupational or other defined exposure to ionizing radiation as causative agent in individuals suffering from or having died of cancer.** (Atomic Energy Control Board, Ottawa, Ontario (Canada). Advisory Committee on Radiological Protection). Feb 1984. 12p. (In English, French). (ACRP—5). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701915/JAW.

For the purpose of workmen's compensation and other medico-legal reasons it is frequently desirable to decide in a given case of cancer if this cancer is the result of occupational exposure to ionizing radiation. This question, as a rule, can be decided only in terms of probability. It is the view of the Advisory Committee on Radiological Protection that the use of 'causative odds' calculations is one useful step in the evaluation of individual cases. The calculation of causative odds in a given case does not provide an exact mathematical probability of the cancer having resulted from exposure to radiation, but give a broad indication of the magnitude of this probability. Other factors must be taken into account, and a semi-quantitative descriptive classification should be used rather than exact numerical values of probability.

24211 **(INFO—0121) Harm to offspring of women of childbearing age employed in the the nuclear industry. .** (Atomic Energy Control Board, Ottawa, Ontario (Canada). Advisory Committee on Radiological Protection). Feb 1984. 25p. (In English, French). (ACRP—6). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701916/JAW.

This report evaluates risk arising from employing women of childbearing age in occupations where exposure to ionizing radiation is likely. It was assumed that about seven percent of women employed in the nuclear industry would give birth to a child in a given year, and that the period of unrecognized pregnancy is 60 days. Using data on risk factors per rem, critical periods for individual end points, and the proportion of women pregnant per year, the risk of harm to offspring was calculated. The forms of harm considered were failure to implant, mental retardation, and induction of cancer. Calculated risk factors were applied to exposure data from the Pickering Nuclear Generating Station from 1981. The maximum harm that can be expected to be produced as a result of exposure of 100 women as mechanical maintenance workers under these conditions would be three cases of either congenital malformation or cancer per 100 years.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

24212 **(ORNL/M—493) Stable isotope research pool inventory.** (Oak Ridge National Lab., TN (USA); USDOE Office of Energy Research, Washington, DC. Chemical Sciences Div.). Feb 1988. Contract AC05-84OR21400. 62p. (INDC(USA)—100/L; NEANDC(US)—225/U; DOE/NDC—46). NTIS, PC A04/MF A01; GPO Dep. Order Number DE88007007/JAW.

This report contains a listing of electromagnetically separated stable isotopes which are available at the Oak Ridge National Laboratory for distribution for nondestructive research use on a loan basis. This inventory includes all samples of stable isotopes in the Research Materials Collection and does not designate whether a sample is out on loan or is in reprocessing. For some of the high-abundance, naturally occurring isotopes, larger amounts can be made available; for example, Ca-40 and Fe-56.

0702 Radiation Sources

24213 **Los Alamos neutron source meets first test.** Robinson, A.L. *Science (Washington, D.C.);* **228**: 1417-1419(21 Jun 1985).

26 April was a day for celebrating at the Los Alamos National Laboratory as jubilant researchers stored a beam in the Proton Storage Ring (PSR) on the very first attempt. The PSR is a $22-million addition to the Weapons Neutron Research (WNR) facility whose effect will be to convert the WNR into a world-class pulsed source for neutron scattering on a par with the British Spallation Neutron Source that recently entered the commissioning phase at the Rutherford Appleton Laboratory (l). The combined WNR/PSR facility will be dedicated this August as the Los Alamos Neutron Scattering Center (LANSCE). However, two important provisos to be satisfied before researchers can tap the intense neutron beam the WNR/PSR will provide are the construction of an experimental hall sufficiently large to house research instrumentation and the development of the instrumentation itself. Now set at $17.5 million, funding for this purpose has never made it into the presidential budget.

08 Hydrogen

REFER ALSO TO CITATION(S) 24539

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 24216

24214 (AFME—82-261) Methane production from food industry solid wastes. Garcia, J.L.; Guyot, J.P.; Ollivier, B.; Labat, M.; Paycheng, C. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). Oct 1983. 171p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88752371/JAW.

The bacterial microflora in a 70 l digester during the methanization of sugar beet pulps processed with Trichoderma harsianum was quantified and isolated. Five bacteria phyla (Escherichia Coli, Desulfovibrio sp. Acetobacterium woodii, Methanobacterium formicicum and Methanosarcina barkeri) were then associated and immobilized in nutritive agar for the methanization of saccharose. The methane production kinetics are affected by the bacteria rates.

24215 (AFME—85-09-1184-3) Biogas: integrated systems, diffusion programs, biogas for motorized systems. Varagnat, F. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). May 1984. 315p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88752366/JAW.

Eleven communications concerning biogas technology and utilization are presented in this document. Some biogas digesters are described together with precisions on the problems and difficulties encountered during construction or utilization (mainly the problem of the digester effluents). Compost possibilities are also presented and the various biogas technology demonstration and diffusion programs in India, Africa and South America (Brazil) are described and compared. A Small biogas fuelled motor is also studied.

24216 (BNL—40731) The HYDROCARB process: Conversion of carbonaceous materials to clean carbon and gaseous fuel. Steinberg, M. (Brookhaven National Lab., Upton, NY (USA)). Dec 1987. Contract AC02-76CH00016. 24p. (CONF-880215—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006302/JAW.

From Energy from biomass and wastes; New Orleans, LA, USA (15 Feb 1988).

HYDROCARB is a two-step process for producing a clean carbon black solid fuel and a co-product hydrogen-rich or methane-rich clean fuel gas from such raw carbonaceous materials as coal, wood, and municipal solid waste. The carbonaceous raw material is first hydropyrolyzed in an excess of hydrogen to convert the majority of the carbon in the raw feedstock to a methane-rich process gas containing smaller equilibrium amounts of CO, CO_2, H_2O, H_2S and N_2. The solid ash and impurities remain behind. After removal of water, the process gas is raised in temperature to thermally decompose the methane to carbon black and hydrogen. The process is completed by recycling the hydrogen-rich gas to the hydropyrolyzer, and the excess gas is withdrawn as a clean medium Btu hydrogen-rich or methane-rich gas after removal of H_2S. Much of the sulfur can be removed in the hydropyrolyzer by the addition of limestone. The process chemistry applied to a bituminous coal is described. The process can essentially be described as a distillation of carbon from the carbonaceous material with the use of hydrogen to a clean carbon black fuel form. 3 refs., 2 figs., 7 tabs.

24217 (CR—SPE3/UP/4) Kitchener landfill gas utilization project. (Conestoga - Rovers and Associates, Waterloo, Ontario (Canada)). Aug 1987. 63p. (In French). (MICROLOG—87-06110). Environmental Protection Directorate, Environment Canada, 351 St. Joseph Blvd., Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In October 1981, Waterloo presented a proposal and application to Environment Canada for funding under the DRECT program for a proposed landfill gas extraction and utilization system at the Kitchener landfill site in Kitchener, Ontario. The project was to be undertaken in two phases and to be completed by the end of March 1984. Phase 1 consisted of the design and installation of a pumphouse and pumping equipment, fifteen southern sector wells, gas transmission lines, and the conversion of one boiler at Bestpipe for acceptance of landfill gas as a fuel supply. The completion was delayed by low methane concentrations and operational difficulties. Following Phase 1, an extensive investigation of the landfill gas utilization system was undertaken to determine the cause of the operational difficulties which persisted throughout the intial phase of the project. Based on the findings of this investigation a Phase 1 Optimization Plan was carried out and a modified Phase 2 plan was recommended. 17 figs., 14 tabs.

24218 (DOE/CH/10093—6, pp 237) Biomass-fired low-Btu gasifiers and/or small- to medium-sized combustion systems. Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Commercial development of low-Btu biomass gasifiers and small- to medium-sized combustion systems is hindered by a lack of documented performance, reliability, economic, and environmental sensitivity data. Information about these variables needs to be developed and disseminated to foster interest in commercial development of these technologies. A four-phase work plan to achieve the objectives of this study has been laid out: (1) delineation of a series of nationally accepted standard tests, methods, and protocols that can be used to determine the operation, performance, and environmental sensitivity of the system; (2) the preparation and implementation of a rigorous and verifiable test and sampling plan to identify and measure system variables - operation, performance, reliability, emissions, effluents, and waste streams; (3) data collection and analysis of system development, design and engineering, operation, cost and economics, and environmental issues; (4) documentation of system design, performance and operation, test and sampling methods, and environmental impacts.

24219 (DOE/CH/10093—6, pp 245) Wood energy design workshops. Walsh, J. (Georgia Institute of Technology, Atlanta). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

This project is intended to provide workshops for architects, engineers, and plant managers who design wood energy systems. The workshops will cover information on both technical and economic issues related to wood energy system design including (1) wood fuel properties, (2) fuel procurement, (3) fuel receiving and handling, (4) combustion and gasification systems, (5) emission control, (6) cogeneration, and (7) case studies. Eight workshops will be presented in the Great Lakes region. The contractor has developed a handbook and audio-visual materials; scheduled workshop dates, locations, and sites for the workshops; and implemented a promotional plan. To date, five workshops have been conducted.

24220 (DOE/CH/10093—6, pp 253) Wood energy conversion workshops. Spelman, P. (Progressive Architects, Engineers and Planners, Inc., Grand Rapids, MI). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

There are vast quantities of wood residues available in the Great Lakes region for energy production. However, non-forest products industries and public institutions have been reluctant to convert to wood fuels. This project will provide industrial, commercial, and institutional energy users in the Great Lakes region with information about wood energy systems through a series of one-day workshops. The workshops will cover (1) wood fuel specifications, (2) wood fuel contracting, (3) wood fuel storage and handling, (4) combustion and gasification equipment, (5) emissions control and state permitting, and (6) successful case studies. The information will be presented at the workshop utilizing audio-visual materials. A comprehensive and well-written handbook will be provided to each workshop participant. The handbook will contain all pertinent information and data presented at the workshop. The par-

ticipants will be able to use the handbook as a ready reference after the workshop has been completed. Successful use of wood for energy at industrial-size facilities will be highlighted by case studies of existing systems, which have been compiled by the Great Lakes Regional Biomass Energy Program. A total of 11 workshops will be presented in the Great Lakes region.

24221 (DOE/CH/10093—6, pp 295-296) **Modification and upgrading of wood gasification system at the Northwest Georgia Regional Hospital, Rome, GA.** Allen, J.F. (Georgia Forestry Commission, Macon). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The Northwest Georgia Regional Hospital's gasifier system is one of the largest in the world. Still, low-Btu gasification is not fully commercial because of a combination of fuel feed, handling, and storage problems; gasifier flameouts; high liquid effluent water contents; and poorly defined gasifier operating conditions, problems that have also been experienced at this hospital site. The gasifier at Rome can serve as an important industrial-scale test bed, and further research performed here can help answer many of the questions that remain concerning wood gasification. The investments required for a wood gasifier retrofit can be considerably less than the cost of a new wood-fired boiler system. Past and current problems with the wood gasifier system will be reviewed. The review will concentrate on the fuel handling and gasifier fuel systems, where the majority of system breakdowns have occurred, and will utilize the consulting services of a recognized expert in the design and operation of wood handling and feed systems. Appropriate system modifications will be identified, which are anticipated to include redesign of the fuel feed, installation of a screening system, addition of a metal detector for the fuel feed, and modification of the feed auger system and rotary air lock. Implementation of the modifications identified by the review will be coordinated with Applied Engineering, vendor for the original gasifier system. Upon project completion, a final report will be prepared that documents the modifications made, system performance and availability, cost savings achieved, and maintenance record. The report will be made available to industry and the public. Work to date is described.

24222 (DOE/CH/10093—6, pp 301-302) **Wood energy utilization in Kentucky.** Stapleton, J. (Kentucky Center for Energy Research, Lexington). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is designed to meet four basic objectives: (1) to foster and build awareness of opportunities for wood utilization in Kentucky in the industrial/commercial/institutional sectors, (2) to provide a focus for information transfer of results from research and development efforts, (3) to establish an effective liaison for meeting regional energy objectives, and (4) to establish a demonstration project for the use of a low-Btu gasifier (using corncobs) in an actual farm operation. An information packet will be developed to answer public inquiries and promote wood energy use. Existing wood users will be surveyed to identify biomass energy problems and costs and to possibly develop case studies demonstrating wood energy economic viability. The 1.5 million Btu per hour biomass gasified-combustion unit was purchased and delivered to the University of Kentucky experiment farm at Princeton, Kentucky, for delivery to the farmer/cooperator. Installation of the gasifier on the farm of Mr. Wayne McTee in Trigg County is nearly completed. It is estimated the biomass burner can save 1/3 to 1/2 of the drying cost associated with gas-fired crop dryers.

24223 (DOE/CH/10093—6, pp 316-317) **Corn cob gasifier for crop drying and space heating.** Lenhardt, N.J. (Missouri Dept. of Natural Resources, Jefferson City). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A Missouri farm site has been selected for the gasifier demonstration. A Buck Rogers Model 14 portable gasifier will be installed at the farm site and operated through two grain-drying seasons. The farm site will provide corn production and storage capacity of approximately 80,000 bushels of corn, and an existing continuous flow batch-type grain dryer. The grain dryer at the farm site will be converted from propane operation to gasifier fuel operation. Data will be collected on the acres and bushels of corn cob fuel, and the moisture content of the grain before and after drying. The initial gasifier tests were run using corn cobs left over from the previous growing season. Approximately 100 acres of corn have been planted this growing season in anticipation of August-September harvest and gasifier/cob collection and separation tests. Several loads of dried grain were test-marketed at a grain elevator geographically removed from the physical site to determine whether the grain operation could detect any foreign odors or discoloration of the grain due to the corn-cob-produced dryer heat. No odors or discoloration was found. A new corn cob collection mechanism will be fitted to the combine. The cobs will be separated from the grain at the combine and delivered to a wagon in tow behind the combine.

24224 (DOE/CH/10093—6, pp 324-325) **Methane recovery from an anaerobic lagoon.** Safley, L.M. (North Carolina State Univ., Raleigh). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A lagoon biogas recovery system will be integrated into an existing anaerobic digester, engine/generator system. At present, a mixed tank anaerobic digester with engine-generator is operating on the Darrell Smith Farm, Princeton, NC. Manure from the 70,000 caged-layer facility is processed through the digester with the resulting effluent being stored in an adjacent anaerobic lagoon. At present, 55% to 70% of the potentially available biogas is captured in the digester. It is anticipated that an additional 6000 to 10,000 cubic feet of biogas/day can be captured with the lagoon gas recovery system. The proposed system will consist of a floating hypalon membrane to cover approximately 20% (70 ft x 120 ft) of the lagoon's surface area. The gas will be pulled from under the membrane under a slight vacuum using a small blower. The gas will pass through a volume meter before being added to the gas stream from the existing digester. The combined gas flow will then enter the existing gas processing and storage system. Before the lagoon floating cover is installed, a heating grid will be installed under the surface of the lagoon. This piping grid will use excess engine/generator heat to evaluate the lagoon temperature. At present 6 million Btu/day are available for such heating. With the additional lagoon gas recovered there could be as much as 8 million Btu/day for heating the covered area of the lagoon. Heating the lagoon should maximize the gas production rate. Once the completed system is in place, it will be monitored to include the following: daily gas production (ft^3), % CH_4 in gas, heat delivered to the lagoon, and lagoon temperature. Design and construction work are complete. Monitoring of gas production is in progress.

24225 (DOE/CH/10093—6, pp 334-335) **Integrated system for methane production from biomass and wastes using multiple reactors and feedstocks.** Nordstedt, R.A. (Univ. of Florida, Gainesville). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Methane generation technology has changed with the development of new types of anaerobic reactors for treatment of different types of wastes and for generation of methane from biomass. Utilization of reactor effluents is an aspect of methane generation that has immense economic and environmental implications. Demonstration of an integrated system of methane generation and effluent utilization would help define operating procedures and assist designers of large, commercial systems. Five activities have been identified to achieve the project objectives: (1) demonstrate the use of three anaerobic reactors to produce methane from multiple feedstocks, a dilute waste stream, and aquatic biomass; (2) demonstrate the efficacy of effluent treatment and utilization through the production of algae and aquatic biomass on the reactor effluents; (3) determine aquatic biomass storage losses and feasibility of long-term and short-term aquatic biomass storage; (4) determine the best combination of the above units and the best operating conditions for achieving an integrated system by using mathematical modeling and

computer simulation techniques; and (5) demonstrate the effectiveness of the system through operation and monitoring. Work has been completed and the results are summarized.

24226 (DOE/CH/10093—6, pp 336-337) **Energy generation through gasification: combustion of low-density biomass.** Parker, B.F. (Univ. of Kentucky, Lexington). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

There is a recognized potential to generate energy from low-density biomass materials such as corn stover, cotton stalks, straw, and soybean vines. Currently these materials can be gasified and burned in a clean burning operation using the relatively high-technology, fluidized-bed technique. It appears that a much more economical energy conversion system might be developed using a fixed-bed gasifier. An in-depth literature search will be conducted to identify additional information that will be used in design and modification of the gasifier system. An existing updraft corn cob gasifier-combustor will be modified to gasify low-density biomass materials and combust the gases in an adjacent chamber. Laboratory tests will be conducted to develop a mechanical system for feeding and uniformly distributing chopped straw into the gasification chamber. Laboratory tests will be made to determine the influence of injecting the primary combustion air, probably with some recirculation of exhaust, on the burning of low-density biomass material. After modifications have been made in the gasifier-combustor, initial combustion tests will be conducted using two biomass materials selected from wheat straw, corn stover, leaves, horse manure and straw mix, and tobacco stems. The test will include measurement of temperature in the gasification and combustion chambers, and particulates and gaseous components in the exhaust. Progress to date is described.

24227 (DOE/CH/10093—6, pp 362-363) **R and D technical and economic analysis.** Shen, S.Y.; Neenan, R. (Argonne National Lab., IL). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW. Contract W-31-109-ENG-38.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives of this task are to develop a comparative analysis of major options for fully integrated anaerobic digestion fuel cycles, including those associated with municipal solid waste; develop a case study showing how coordination with conservation programs could affect the technology and the economic viability of biomass production; and examine alternative technologies for medium-Btu gas. ANL will search the literature and work with existing data bases to supply the foundation for coordinating the anaerobic digestion fuel cycle elements, including the collecting, transporting, and storing of feedstock. From this information, a comparative analysis of major options will be developed. An energy crop-soil conservation analysis will be conducted to gain insights into the benefits achievable by coordinating agricultural and energy policy. Particular attention will be given to the administrative feasibility of coordinating biomass production and soil conservation. The commercial feasibility of alternative technologies from medium-Btu gas production will be examined. This study will focus on on-site industrial applications, including cogeneration, where the pollution-control benefits are greatest and the transportation penalties least for medium-Btu gas.

24228 (DOE/ER/13719—1) **One carbon metabolism in anaerobic bacteria: Regulation of carbon and electron flow during organic acid production: Progress report, February 1, 1987-February 1, 1988.** Zeikus, J.G.; Shen, Gwo-Jenn. (Michigan Biotechnology Inst., Lansing (USA)). 1988. Contract FG02-87ER13719. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006629/JAW.

These studies concern the fundamental biochemical mechanisms that control carbon and electron flow in anaerobic bacteria that conserve energy when coupling hydrogen consumption to the production of acetic, propionic, or butyric acids. Two acidogens, Propionispira arboris and Butyribacterium methylotrophicum were chosen as model systems to understand the function of oxidoreductases and electron carriers in the regulation of hydrogen metabolism and single carbon metabolism. In P. arboris, H_2 consumption was linked to the inhibition of CO_2 production and an increase in the propionate/acetate rate; whereas, H_2 consumption was linked to a stimulation of CO_2 consumption and an increase in the butyrate/acetate ratio in B. methylotrophicum. We report studies on the enzymes involved in the regulation of singe carbon metabolism, the enzyme activities and pathways responsible for conversion of multicarbon components to acetate and propionate or butyrate, and how low pH inhibits H_2 and acetic acid production in Sarcina ventriculi as a consequence of hydrogenase regulation. 9 refs.

24229 (DOE/ER/13730—1) **Enzymological studies of one-carbon reactions in the pathway of acetate utilization by methanogenic bacteria: Annual technical report for the period 6/1/87 to 1/31/88.** Ferry, J.G. (Virginia Polytechnic Inst., Blacksburg (USA)). Jan 1988. Contract FG05-87ER13730. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006539/JAW.

The general pathway of acetate conversion to methane in Methanosarcina thermophila is known and several of the enzymes have been characterized. AcetylCoA is cleaved by a enzyme complex with carbon monoxide dehydrogenases activity. The methyl group is transferred to Coenzyme M and the carbonyl to the nickel site in the complex. Methylcoenzyme M is reductively demethylated to methane with electrons derived from the oxidation of the bound carbonyl. A ferredoxin is the immediate electron acceptor of electrons leaving the complex. Membrane components are implicated in electron transport from the ferredoxin to methylcoenzyme m. A corrinoid protein in the complex is thought to catalyze methyl transfer, electron transfer, or both. All of the above proteins have been purified except the corrinoid protein. Our laboratory is investigating the catalytic mechanism of the purified proteins. Biochemical characterizations of all proteins will include amino acid analysis and N-terminal sequencing, kinetic parameters, physical and other properties. 2 tabs.

24230 (DOE/PC/90533—5) **Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, September 15, 1987-December 15, 1987.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 29 Feb 1988. Contract FG22-86PC90533. 19p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006655/JAW.

This report describes recent progress in a fundamental, three-year investigation of carbon formation and its effects on the activity and selectivity of promoted iron catalysts for FT synthesis, the objectives of which are: determine rates and mechanisms of carbon deactivation of unsupported Fe and Fe/K catalysts during CO hydrogenation over a rage of CO concentrations, CO:H_2 ratios, and temperatures; model the rates of deactivation of the same catalysts in fixed-bed reactors. During the fifth quarter further progress was made in the construction of a computer-automated reactor system to be used in the kinetic and deactivation studies. A new HP5890 chromatograph was received, tested and instaled for this system. Modifications were made to the fixed bed reactor system to enable the H_2 and CO partial pressures to be varied systematically. 47 refs.

24231 (PIRSEM—1001) **Research about cellulolytic and methanogenous bacterial species and associations.** Bianchi, A.; Marty, D. (Centre National de le Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matieres Premieres). 1986. 12p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752388/JAW.

In this study, aerobic and anaerobic bacterial populations are counted in numerous sedimentary samples gathered in various biotopes (sea, lagoon, liquid manure, etc...). Some methanogenous phylla, cellulolytic phylla and non-cellulolytic fermentation phylla have been purified and studied (morphology, physiology, biochemistry) and the possibilities of some simple bacterial associations for the degradation of cellulose into methane are examined.

0902 Alcohol Fuels

24232 **(CRIQ—87) Production of ethanol and polyols by fermentation using osmophilic yeast.** Groleau, D. (Centre de Recherche Industrielle du Quebec, Sainte-Foy (Canada)). 1987. 116p. (In French). (MICROLOG—87-05535). Bioenergy Development Program. Renewable Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Biomass can be used as an oil substitute in two ways. It can be converted to ethanol, methane and other energy sources that replace fossil fuels, or transformed into chemical substances that in all probability would otherwise be produced from oil. The overall objective of this project was to develop a fermentation process using an osmophilic yeast that will allow certain sugars to be converted to a mixture of ethanol and industrial polyols. The ethanol could be used as a liquid fuel; some of the polyols are already being used in the chemical, food and pharmaceutical industries. This report contains the results of the first phase which was to demonstrate the feasibility within the scope of the laboratory of the fermentation process. 18 figs., 10 tabs.

24233 (DOE/CH/10093—6, pp 284-285) **Pervaporative dehydration of ethanol.** Gooding, C.H. (Clemson Univ., SC). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Pervaporation is a membrane process in which selected components of a liquid feed absorb into the membrane, diffuse through, and evaporate into a low-pressure region on the other side. Unlike reverse osmosis, pervaporation circumvents the thermodynamic problem of osmotic pressure by the change of phase. Thus, in principle, pervaporation can be used near the azeotropic composition in conjunction with simple distillation to separate ethanol and water. The tasks of the project included (1) pervaporation experiments with four commercial membranes to include flux and selectivity measurements as a function of feed temperature, feed composition, and permeate pressure; (2) engineering and economic analysis of the experimental results; (3) mathematical modeling of the data; and (4) preparation of a comprehensive report. This project has been completed and the results are summarized.

24234 (DOE/CH/10093—6, pp 338-339) **Production and fermentation of crystalline sugars from biomass.** Sitton, O.C. (Univ. of Missouri, Columbia). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The primary objectives of this work are to (1) remove the sugars produced in the acid hydrolysis of biomass as crystalline sugar, thereby allowing near total recycle of the acid catalyst and (2) convert both xylose and glucose to ethyl alcohol in high concentration using an immobilized yeast, Pachysolen tannophilus. Three activities were defined to accomplish the project objectives: (1) screen appropriate adsorbents for maximum sugar capacity and selectivity by measuring the adsorption isotherms for glucose, xylose, furfural, and cellobiose in water and ethyl alcohol solvents; (2) immobilize P. tannophilus in polymer gels; and (3) study the performance of this organism at high sugar concentration with simultaneous removal of the ethyl alcohol product in a packed-bed counterflow reactor. A device was constructed to measure how much sugar a given quantity of solid adsorbent would hold when exposed to solutions of varying concentration. The resulting adsorption isotherm is required to design the separation unit and to verify the feasibility of the approach. The system was tested and several adsorbents, including silica gel, ion-exchange resins, and activated carbon (used in further studies), were screened. Results were summarized.

24235 **(GBR—8706) Conversion of methane into methanol using methanotrophs. Final report.** (Gemini Biochemical Research Ltd. (Canada)). Jun 1987. 67p. (MICROLOG—87-05184). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Methane oxidizing bacterium was tested for its ability to accumulate methanol under a number of conditions. Under the conditions used to grow the organism, the insoluble form of the enzyme was produced. This form of methane monooxygenase is very sensitive to inhibition by potassium cyanide. This inhibitor is added to preparations of the enzyme to prevent the further oxidation of the initial product of the reaction, namely, methanol. Without the addition of the cyanide it is impossible to accumulate methanol since it is oxidized by the enzyme methanol dehydrogenase which is also present in the preparations. Attempts to physically separate the two enzymes by differential centrifugation were unsuccessful. Other short chain alkanes and alkenes were substrates for the enzyme and their products could be accumulated under similar conditions to those used for methanol accumulation.

24236 **(WU/C—8703) Direct partial oxidation of methane to methanol over designed heteropoly catalysts. Final report.** Moffat, J.B. (Waterloo Univ., Ontario (Canada). Dept. of Chemistry). Mar 1987. 166p. (MICROLOG—87-04531). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The partial oxidation of methane has been studied on heteropoly oxometalates with Keggin structure anions of various compositions. Nitrous oxide and oxygen have been employed as oxidants. The catalysts examined were supported on high area silica and activated in helium, air or hydrogen. The selectivity to partial oxidation products methanol and fomaldehyde was found to be inversely related to the conversion of methane. Of those catalysts tested, 12-molybdophosphoric acid appears to be the most effective. Substitution of the protons by heavier cations was found to reduce the selectivity to partial oxidation products. The effect of catalyst loading on the support was also examined. Low residence times, low temperatures and high CH/sub 4/N/sub 2/O ratios (9/1) were found to favour the selectivity to partial oxidation products tested. While selectivities approaching 100% to partial oxidation products can be obtained, conditions which reduced the conversion to less than 1% were required. 19 figs., 2 tabs.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 24216, 24218, 24219, 24220, 24329

24237 **(AFME—85-91-1001-9) Roast wood: costs and position compared to other fuels.** Peguret, A. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1986. 24p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752365/JAW.

The roast wood production costs are calculated in this study; calculations are performed for various costs of wood (delivered at the roast facility) and various humidity rates. The price of the heat produced with roast wood particles is also evaluated and compared to the heat produced with other fuels. The results show that roast wood particles are not competitive in most of the cases.

24238 (DOE/CH/10093—6, pp 219) **Environmental impacts of advanced residential and institutional biomass combustion.** Burnet, P.E. (OMNI Environmental Services, Beaverton, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of this project is to measure the rate of emission of pollutants to the environment as a result of combustion in advanced systems. Advanced residential and institutional biomass combustion systems will be tested under varying operating conditions, according to accepted or acceptable methods, to estimate their environmental impact. Four advanced systems will be tested

using biomass fuels from the Pacific Northwest and Alaska. The devices being tested are (1) a natural draft refractory burner, (2) a catalytic wood stove, (3) a pellet-fired wood stove, and (4) a pellet-fired boiler. Work has begun on the preparation of bioassay samples for analysis.

24239 (DOE/CH/10093—6, pp 220) **Environmental impacts of wood combustion in residential woodstoves.** Tiegs, P.E. (OMNI Environmental Services, Beaverton, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A methodology for assessing the carbon monoxide air quality impact from woodstoves in urban areas is to be developed. Actual wood stove use is being sampled. An accurate composite estimate of wood fuel use for the region is being calculated. Wood pellet heating appliances are being tested and correlations of firebox size, emissions, and efficiency developed. Effective mitigating measures and a decision model for their application are being developed. The field work has been completed. All data have been collected and are being analyzed and formatted for inclusion in the final report on wood stove emissions, environmental impacts, and efficiency issues. A final draft of the Compendium of Environmental and Safety Regulations and Programs Affecting Wood Heating Appliances has been reviewed by a peer group. The group's responses to the publication have been gathered under separate cover.

24240 (DOE/CH/10093—6, pp 230) **Regional reduction in air pollutant emissions as a result of increased forest residue recovery.** Sandberg, D.V. (Forest Service, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The main components of this research effort focus on the (1) testing of the hypothesis that pretreatment woody biomass loadings on harvested sites in Oregon and Washington have decreased by 20% since 1981, (2) testing of the hypothesis that air pollutant emissions from prescribed burning have been reduced because of increased utilization since 1981, and (3) characterization of duff and live vegetation to improve emission source strength models and smoke management systems. Field data collection is ahead of schedule. Landowners and managers were contacted to obtain access permission, unit statistics, and maps. Field inventories have been completed on 170 logged units in western Oregon and Washington and on an additional 25 units in eastern Washington, Early results indicate that an improvement in slash utilization has indeed occurred since 1981.

24241 (DOE/CH/10093—6, pp 233) **Test and evaluate the combustion characteristics of selected biomass fuels - standards development.** Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

After sampling methodologies, procedures, protocols, and standards have been determined, six samples of each of the chosen fuel types will be tested in a minimum of three sampling locations. The fuels are to be tested and analyzed for (1) combustion and handling characteristics; (2) heating value; (3) proximate analysis; (4) ultimate analysis; (5) physical properties - size, density, moisture content, and wood-to-bark ratio; (6) abrasive and corrosive properties; (7) fly ash; (8) slagging; and (9) environmental factors. Evaluations will also be made on fuel feed requirements, system changes or modifications necessary to accommodate biomass fuels, and the potential for co-firing with fossil fuels.

24242 (DOE/CH/10093—6, pp 238) **Technical and economic assessment of using small- to medium-sized processing equipment to produce densified biomass fuels (pellets) for small or local markets.** Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Small- to medium-sized pelletizing equipment is available on the market, but information about the economics of these units is limited. One question that needs to be answered is whether it is economically wise to scale a production facility to a smaller market. After densification systems capable of processing municipal solid waste (MSW), wood, and agricultural residues have been identified, the technical and performance characteristics of these systems will be documented. The contractor will then develop the following: (1) cost information and operating scenarios for various ranges of permanent or portable densification systems; (2) cost comparisons and break even points for producing densified fuels using MSW, wood, or agricultural wastes, combined or alone; and (3) cost comparisons with other solid, liquid, and gaseous fuels. As part of the study, a qualitative analysis of pellet fuels will be conducted using a case study, and a handbook will be produced for use by small- to medium-sized waste producers.

24243 (DOE/CH/10093—6, pp 239) **Agricultural residue and industrial wood energy case studies.** Feely, A. (Council of Great Lakes Governors, Madison, WI). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Industrial, commercial, and institutional energy users are more likely to consider conversions to biomass fuels if they are presented with information on successful, existing biomass energy facilities. This project will develop 28 case studies focused on biomass energy installations in the Great Lakes region. Of these case studies, 14 will examine industrial/commercial wood energy facilities, and 14 will detail agricultural residue combustion systems. Information presented on each facility will include combustion system type, fuel handling and storage equipment, fuel costs, energy application, and economic return on investment. The case studies will be written in a narrative fashion utilizing photographs and illustrations to further describe each facility. Two booklets containing the case studies will be printed with one of the booklets containing all of the wood energy facilities and the other containing the agricultural residue combustion systems. The booklets will be distributed to interested industrial energy users throughout the Great Lakes region. The wood case study booklet has been completed, and the agricultural case study document is in final preparation for printing.

24244 (DOE/CH/10093—6, pp 240) **Biomass fuel specifications and contracting guide.** Feely, A. (Council of Great Lakes Governors, Madison, WI). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Potential wood energy users in the Great Lakes region do not have a basic understanding of wood energy systems or wood fuel procurement. This project will produce a booklet that describes the method for specifying with characteristics of biomass fuels, drafting a request for bids, and developing a long-term contract. In addition, the booklet will cover wood fuel handling, storage, combustion, and emissions, as well as financing options. The draft guide has been written, and 5000 copies have been printed.

24245 (DOE/CH/10093—6, pp 241) **Wood energy conversion information survey.** King, H.T. (Council of Great Lakes Governors, Madison, WI). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A telephone survey of 200 to 300 businesses and institutions in the region will be conducted to determine the information needs of organizations considering conversion to wood fuel. Organizations that currently use wood will be surveyed as well as those that currently burn fossil fuels. The survey will be designed to measure both the importance and the difficulty of obtaining specific types of information essential to making decisions regarding wood energy conversions, including (1) fuel quality, (2) fuel contracting, (3) fuel storage and handling, (4) emissions requirements, and (5) financing options. The results and analysis of the survey will be compiled into a report and used in the planning process for future projects for the Great Lakes Regional Biomass Energy Program. The telephone survey has been completed. Results from the survey have been tabulated and analyzed.

24246 (DOE/CH/10093—6, pp 246) **Large biomass combustion system demonstration.** Ellsworth, D. (I E Associates, Inc., Minneapolis, MN). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The forest products industry in the Great Lakes region has realized the tremendous economic benefits of utilizing its wood wastes as fuel and has rapidly converted to biomass technologies. However, other large commercial, industrial, and institutional energy users have been hesitant to install biomass combustion equipment. Firms and institutions with non-seasonal requirements for steam either in manufacturing processes or electricity production have been even more reluctant. The major reasons cited for the lack of confidence in biomass combustion technologies include unreliable fuel availability, derated boiler output, unproven economics, and an unwillingness to experiment. Engineering assistance will be provided to one Great Lakes firm contemplating a biomass conversion. The firm selected for assistance will have a substantial non-seasonal process energy load and a commitment to undertake the conversion. While funding is being provided for technical assistance, the selected firm will pay for the biomass equipment and installation costs out of its own budget. After the client is selected, a preliminary technical and economic analysis of the proposed installation will be performed. Engineering specifications for the bidding process will be developed, and alternatives for financing will be identified. South Alma Cheese Company of Alma Center, Wisconsin, has been selected as the industrial cooperator. The wood combustion system has been installed, and initial problems in the system have been worked out. Tours of the facility were held in the fall of 1986.

24247 (DOE/CH/10093—6, pp 248) **Iowa state grant.** Carleton, M. (Iowa Energy Policy Council, Des Moines). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The Iowa Energy Policy Council will assist potential wood energy users assess the economics of conversions through the utilization of a US Forest Service computer program. Approximately 25 different firms and institutions will receive preliminary wood energy conversion economic analysis. To encourage organizations to participate in the conversion analyses, a document will be published that describes wood combustion systems and lists local suppliers of wood fuel. Secondly, a continuation of work on the harvesting, storing, and handling of sorghum is planned. Combustion testing of sorghum, which was postponed from an earlier year, will also be implemented. Lastly, the results of a previously funded regional solid waste management plan will be transferred to the private sector. The Iowa Energy Policy Council has held four workshops statewide to present the results of previously funded municipal solid waste-to-energy studies. It has also sponsored a wood-to-energy conference focused on short-rotation forestry in conjunction with the Iowa Society of American Foresters. Four proposals have been received from vendors in response to an RFP to install an agricultural residue burner.

24248 (DOE/CH/10093—6, pp 249) **Agricultural residue workshops.** Sand, D. (Iowa Natural Heritage Foundation, Des Moines). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Vast quantities of crop residences are available for energy in the Great Lakes region, but they are an underutilized resource. Seven workshops, one in each state in the region, will be conducted for personnel in the US Soil Conservation Service, state agriculture departments, and other interested professionals. The workshops will provide the participants with a methodology to calculate the environmentally safe level of agricultural residue removal from specific fields. An overview of the various biomass combustion systems will also be presented along with the appropriate collection, handling, and storage techniques of crop residues for each system. Successful on-farm utilization of crop residues for energy will be highlighted by case studies of existing systems, which have been compiled by the Great Lakes Regional Biomass Energy Program. The contractor has developed a computer model that will assist in determining the economics of agricultural residue use and the environmental impacts of agricultural residue removal. A draft handbook for the workshop has been submitted.

24249 (DOE/CH/10093—6, pp 251) **Michigan state grant.** McClelland, M. (Michigan Energy Administration, Lansing). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Current consumption of wood for energy by industries in Michigan falls far short of available supply in many areas. The private sector is reluctant to undertake wood fuel conversions because of uncertainty of wood fuel supplies, unfamiliarity with combustion technology, lack of awareness of the economic returns, and lack of capital to finance conversions. Additionally, the recent increased interest in wood for energy has created concern regarding proper forest management, harvesting above levels of growth, competition for wood between forest product industries and wood energy facilities, and long-term forest productivity. The Michigan Energy Administration will provide on-site technical assistance to potential industrial, commercial, and institutional users of wood fuel. Utilizing a modified US Forest Service computer program, a total of 40 preliminary economic analyses will be performed for targeted energy users. Also, a wood energy development plan will be established through a statewide consensus process to ensure the expansion of wood energy is consistent with the broader state goals of forest development and environmental protection.

24250 (DOE/CH/10093—6, pp 252) **Minnesota state grant.** Somdahl, N. (Minnesota Dept. of Energy and Economic Development, St. Paul). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of the project is to validate the types and quantities of emissions from industrial-sized wood chip and pellet burning boiler systems in Minnesota. The project will consist of a series of four emissions tests on different types of biomass combustion systems, a regulatory review, and identification of applicable control technologies. Emissions tests to be performed include CO, hydrocarbons, and selected air toxics. Sites for the emissions tests will be selected by a project team composed of Minnesota Energy Division and Minnesota Pollution Control Agency staff with the cooperation of the boiler owners. Emissions testing will be conducted with the intent of applying the results to other boiler systems of a similar type. Results of these tests will be utilized to provide a preliminary assessment of the impact of uncontrolled and controlled boiler plants on adjacent areas. An emissions modeling exercise will also be conducted, and a review of state air quality regulations will be performed to determine if changes in the emissions requirements for biomass systems need to be made. Hill City School, Pine River Elementary School, Grand Rapids Senior High School, and Swanville Public School were selected as the emissions test sites. Particulate, SO_2, and NO/sub x/ testing were completed.

24251 (DOE/CH/10093—6, pp 254) **Wisconsin state grant.** Moran, D. (Wisconsin Div. of State Energy and Coastal Management, Madison). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives of this program are to provide the private sector with detailed information on industrial wood combustion and to determine ambient polynuclear aromatic hydrocarbon (PAH) concentrations in locations most likely to have elevated concentrations due to residential wood burning. A US Forest Service computer program will be utilized to provide firms and institutions with a preliminary wood energy conversion economic analysis. Approximately 600 firms and institutions currently using natural gas or oil in medium and large boilers will be contacted by mail and offered the service. Areas in the northern part of the state with known surpluses of low-cost wood fuel will initially be targeted, while areas in the far southern and southeastern sections will be assessed on a case-by-case basis. In regards to testing for PAH from residential

wood heating, sampling will occur at the site throughout the 1985-86 heating season. Concentrations of approximately 16 PAHs will be tabulated over the sampling period and compared to appropriate suggested safe limits. Thirty-three industrial wood energy feasibility analyses were completed of which 14 were found to be feasible, 9 were marginal, and 6 were not feasible. Additionally, winter ambient air sampling was finished to identify organic pollutants from residential wood combustion.

24252 (DOE/CH/10093—6, pp 257) **Waste-to-energy workshops.** Walsh, P. (Univ. of Wisconsin, Madison). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

This project will provide municipal and industrial leaders with current information regarding waste-to-energy incinerators through a series of one-day workshops. The workshops will cover (1) generation and disposal of wastes including refuse-derived fuel (RDF), (2) types of incinerators, (3) risk management, (4) project financing, (5) project evaluation, (6) emission control, (7) case studies, and (8) other appropriate topics. The information will be presented at the workshop utilizing speakers knowledgeable in the field of MSW-to-energy systems. Audio-visual material will also be used to highlight major points of discussion. A comprehensive and well-written handbook will be provided to each workshop participant. The handbook will contain all pertinent information and data presented at the workshop. The participants will be able to use the handbook as a ready reference after the workshop has been completed. A total of nine workshops will be presented with one in the Great Lakes region.

24253 (DOE/CH/10093—6, pp 260) **Feasibility of wood fuel feedstocks for resource recovery facilities.** White, A. (Boston Planning Group, MA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives of this project are to identify several planned or existing waste-to-energy facilities that are good candidates for provision of wood chips as a supplemental fuel and to undertake a feasibility study of two of these sites. The economic, institutional, and environmental factors that are most compelling to consider wood chips as a supplemental fuel were determined. A financial model of a theoretical case study in which wood chips would be a viable fuel supplement to MSW was developed. Two feasibility studies of actual facilities were conducted.

24254 (DOE/CH/10093—6, pp 261) **Economic impacts of wood energy in the Northeast.** High, C. (Dartmouth College, Hanover, NH). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective is to provide a reliable, impartial assessment of the economic impacts of wood-energy use in the Northeast on a state-by-state basis. The following tasks have been completed: develop an economic impact model to estimate the direct and indirect impacts of wood-energy use on employment, income, energy savings, and cost savings in the residential, commercial, and industrial sectors; gather existing data and generate new information as needed on the economic impacts of developments in particular wood-energy industries or wood-energy-using businesses or individuals; compile the data on wood-energy use and develop projections for future use and apply the computer model to the data collected.

24255 (DOE/CH/10093—6, pp 262) **Strategic analysis of the targeted facilities conversion program.** High, C. (Dartmouth College, Hanover, NH). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is designed to evaluate the NRBP Industrial Conversion Assistance Programs and to suggest effective strategies for future targeted assistance programs. The rapidly changing environment relative to the economics of wood conversion necessitates a reassessment of the technical services industry. The contractor will determine the following: (1) which industries, of what size, in which locations, for what reasons, are the best candidates for wood energy conversions in 1986; (2) what are the primary barriers to conversion for these top candidates; (3) what, if any, might be appropriate, helpful, and cost-effective government-sponsored efforts to encourage conversions in 1986 and afterward; and (4) what impacts have the activities of the past two years had in encouraging conversions?

24256 (DOE/CH/10093—6, pp 263) **Targeted industrial conversion assistance program.** Hewett, C. (Maine Audubon Society, Falmouth). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective is to demonstrate to targeted candidates the economic attractiveness and technical feasibility of converting to wood fuel. The following tasks have been completed: identify and target specific industries and firms with good potential for using wood for energy; convey the viability of using wood energy through workshops that feature presentations by experts in the field, slide-tap presentations that address specific elements of the conversion, and case studies of successful conversions and help build the level of expertise in state agencies within the region to provide more detailed follow-up assistance to candidate firms.

24257 (DOE/CH/10093—6, pp 264) **Northeast directory of biomass facilities.** Hewett, C. (Maine Audubon Society, Falmouth). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The purpose of this project is to publish a Biomass Facilities Directory, which will provide up-to-date information on the current use of wood for energy. The contractor will contact all potential sources of lists of wood-fired equipment. Detailed questionnaires will be sent to facilities identified as wood burning. Telephone follow-up will occur to both surveyed and non-surveyed firms. The results will be compiled into a comprehensive publication, which can be updated periodically to reflect changes in the wood-energy market in the region.

24258 (DOE/CH/10093—6, pp 265) **Performance monitoring of catalyst stoves, add-ons, and high efficiency stoves: field testing for fuel savings, creosote build-up, and emissions.** Tiegs, P. (OMNI Engineering Services, Inc., Beaverton, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The operation of various woodstoves in homes will be monitored under actual operating conditions over a period of two heating seasons. Study participants will be divided into two groups. The first will receive a new stove representing one of the new technologies or will retain their current stove. These Group One homes will be monitored for creosote build-up, wood usage, and will be sampled for air emissions. The second group will be monitored for creosote build-up and fuel usage only. Different stoves will be placed in some of the study homes for the second year to allow the impact of different wood stove technologies to be monitored. The durability of catalysts will be tested in separate laboratory tests. Data generated during the first year was utilized by US EPA in developing New Source Performance Standards for Wood Stoves.

24259 (DOE/CH/10093—6, pp 278-279) **Biomass energy project grant solicitation.** Davis, E. (Arkansas Energy Office, Little Rock). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is intended to accomplish three major objectives: (1) to survey the approximately 550 households previously identified in Arkansas fuel wood users to obtain information on the volume of fuel wood used in 1985-86 and determine their demographic characteristics; (2) to evaluate the feasibility and potential

for methane generation from food processing wastes under laboratory test conditions; and (3) to investigate the possibility of funding at least one project in which an industrial concern will use biomass energy to displace conventional energy fuels. The telephone survey of residential fuel wood use has begun with over half the households already contacted. The rate of progress has been such that the survey is anticipated to be completed ahead of schedule. Work continues on the project to evaluate the methane generation potential of food processing waste. A two-liter fermenter was purchased and delivered. Shakedown testing of the fermenter is under way. Tests are also being run on the fermenter to determine whether methane can, in fact, be produced and to identify the criteria most important in determining optimum gas production conditions. A draft solicitation for biomass energy utilization profits has been prepared. Interest in municipal solid waste management and energy production has increased significantly. The solicitation may be revised to focus on Arkansas cities, counties, and municipalities with the potential for application of MSW-to-energy technologies.

24260 (DOE/CH/10093—6, pp 280-281) **Wood energy project.** Davis, E. (Arkansas Energy Office, Little Rock). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of this project is a cooperative, multi-agency effort to concentrate on specific areas of wood energy use, including, but not limited to: demonstration of wood energy technology; surveys of industrial and residential wood energy users; intergovernmental coordination; general information gathering; and a broad range of educational efforts (slide/tape presentation, public service announcements, eight publications, three workshops, etc.). Efforts by the University of Arkansas at Monticello, the Arkansas Forestry Commission, the Industrial Research and Extension Center, the Cooperative Extension Service, and the Arkansas Energy Office are described.

24261 (DOE/CH/10093—6, pp 282-283) **Hohenwald waste-to-energy facility.** Arbuckle, J.W. Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The City of Hohenwald, Tennessee, is in a program to build a steam-generating plant to supply industrial steam to one existing industry and hopefully to attract other steam users to the community. Fuel for this facility will be primarily waste wood products generated within a 35-mile radius. In addition, there will be approximately 4 tons per day of industrial wastes burned along with the wood, thereby solving a waste disposal problem for industry. Since steam demand by the industry is not constant, there will be surplus of steam at most times of the day. Part of this steam will be used to generate electricity to be sold to the Meriwether Lewis Electric Co-Operative. Dana Corporation operates an industrial rubber-hose manufacturing facility in the city which is a full-time user of processing steam (80,000,000 lb per year). The steam-generating equipment at Dana is becoming obsolete; so the local management is interested in buying steam rather than renewing or rebuilding the existing equipment. Engineering studies have been made to prove the technical viability of the project.

24262 (DOE/CH/10093—6, pp 287-288) **Phase II - Development of biomass dryer/metering bin.** Christian, J.V. (Engineered Energy Concepts, Inc., Kingsport, TN). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A design prototype of a combined dryer/metering bin was installed at Ala-Tenn Industries of Sheffield, Alabama, in the fall of 1984. The present dryer/metering bin design prototype injects a hot drying medium into the lower portion of the dryer. This medium is evaluated upward through the sawdust load by means of an exhaust fan drawing air from the top of the dryer. This dryer will successively reduce the moisture content of wet sawdust from 43% to 8%. Specific objectives of this proposal are to double the rate of drying and eliminate mechanical hardware by restructuring the bin such that first costs to the user are greatly reduced. All modifications have been made and the modified dryer tested. The phase II silo dryer/metering bin has successfully eliminated those structural problems associated with the phase I dryer metering bin. The phase II project has also eliminated two augers, three electric motors, and a complicated electrical circuit. This elimination makes for a more economical storage, drying, and metering package for the end user. The total cost of this project was a little less than $40,000. However, it is felt that a second and third edition could be produced for a $30,000 retail price to the end user.

24263 (DOE/CH/10093—6, pp 289-290) **Sawdust drying for cyclic or steady-state processes.** Christian, J.V. (Engineered Energy Concepts, Inc., Kingsport, TN). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A biomass drying and combustion system to generate steam for a wood treating process was installed, with grant assistance from SERBEP, at Ala-Tenn Wood Preservers of Sheffield, Alabama, in the fall of 1984. The specific objective of this project is to make available to the sawdust dryer an adequate and continuous supply of drying media during 95% of the process cycle time by utilizing steam/hot water heating coils to produce hot air as the drying medium. All equipment has been installed and tested and is performing to expectations. The drying rate is approximately 1000 lb/h of green sawdust yielding 666 lb/h of 10% dry fuel. Approximately 200 lb/h of dry fuel (10% H_2O) is required to dry 1000 lb/h of green fuel to a moisture content of 10% w.b. In two days or less, one week's supply of dry fuel is available for the combustion process. This is almost five times better than the drying rate of The phase I dryer. For this application the phase II dryer is worth approximately $1000 per month in savings. Those savings are measured in cost of fuel savings, increased production, and as a positive backup fuel source. The hot air temperature must be controlled at 250°F or less to prevent fires. It is also recommended that the system run continuously once started as a safety precaution against spontaneous combustion. Also, highly recommended for safety is the use of smoke detectors and alarms and the placement of adequate explosion vents.

24264 (DOE/CH/10093—6, pp 297-298) **Ala-Tenn technical brief.** Huff, C.H. (Georgia Tech Research Institute, Atlanta). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is intended to accomplish the following: (1) to prepare and publish a concise brief describing the major technical details and results of the Georgia Tech Clean Combustion Off-Gas Project, which is designed to demonstrate, on a bench scale, a rotary recycling method for separating clean off-gas from combustion or thermal conversion of biomass and (2) to make this information easily available to Southeast industries to encourage their adoption of biomass energy technology. The brief will be written as a technical report for nonresearchers interested in practical applications rather than extensive descriptions of test methods and data. Content will include a comparison of current technologies and practices with the new technologies, delineating advantages and disadvantages of each. Economics, risks of implementation, and decision criteria will also be included.

24265 (DOE/CH/10093—6, pp 299-300) **Clean combustion off-gas.** Huff, C.H. (Georgia Tech Research Institute, Atlanta). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is intended to accomplish the following: (1) to prepare and publish a concise brief describing the major technical details and results of the Georgia Tech Clean Combustion Off-Gas Project, which is designed to demonstrate, on a bench scale, a rotary recycling method for separating clean off-gas from combustion or thermal conversion of biomass and (2) to make this information easily available to Southeast industries to encourage their adoption of biomass energy technology. The brief will be written as

a technical report for nonresearchers interested in practical applications rather than extensive descriptions of test methods and data. Content will include a comparison of current technologies and practices with the new technologies, delineating advantages and disadvantages of each. Economics, risks of implementation, and decision criteria will also be included.

24266 (DOE/CH/10093—6, pp 306) **Co-combustion of biomass and fossil fuel(s): a survey of the state of the art.** Makansi, J. (Power Magazine/McGraw-Hill, Inc., New York, NY). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Cofiring biomass and other fuels offers significant advantages including improved utilization of indigenous resources and wastes, improved efficiency, increased throughput, environmental benefits such as reduced sulfur emissions, and opportunities for enhancing local economic development. Although some project experience has been published in journals and conferences, summary information on the scope and results of cofiring projects is unavailable. The objectives are to compile information on industrial experiences and research experiments and assemble a directory of activities from which research needs and industry interests can be assessed and quantified. More than 500 facilities world-wide were identified with approximately 25% of the facilities outside the US. These facilities have the potential to cofire but are not necessarily cofiring. The majority of the facilities identified were in the pulp and paper industry, and the majority of cofiring situations involved wood and coal.

24267 (DOE/CH/10093—6, pp 310-311) **Bullock County Prison - wood-fired boiler.** Stanford, R. (Alabama Dept. of Economic and Community Affairs, Montgomery). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A major emphasis of the Energy Division of the Alabama Department of Economic and Community Affairs (ADECA) for approximately five years has been promoting wood energy in facilities owned and occupied by the State of Alabama. This project is specifically designed to (1) install a wood-fired boiler in a new prison facility to be located in Bullock County, near Union Springs, Alabama, and (2) show Alabama corrections officials that wood is an attractive fuel source to meet prison facility energy needs. Prison System Management has agreed to utilize a wood-fired boiler in the new Bullock County prison, which is being designed as a 611-man prison and is scheduled to be operational in 1986. Payback on fuel savings is anticipated to be such that the feasibility of using wood-fired systems in state facilities throughout Alabama will be demonstrated. Third-party financing will be used to pay for the system, and ADECA will provide funds for preliminary accounting and legal costs. ADECA will also be responsible for acquiring a fuel source and monitoring system construction. SERBEP funds will be used to pay the engineering cost for design of the wood-fired boiler system. Following completion of system design, bid specifications will be issued, a vendor selected, and the system installed. Progress to date is described.

24268 (DOE/CH/10093—6, pp 312-313) **Demonstrating and operating a wood-fired, stick-fed heating system.** McKoy, W.H. (Mississippi Dept. of Energy and Transportation, Jackson). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Housing units at Parchman State Penitentiary now use electricity and both natural and LP gas. The project is designed to (1) identify a suitable housing facility as Parchman for conversion to wood heat; (2) determine the optimum wood-burning system to be used including considerations of economy, safety, operations and maintenance, and reliability; (3) procure and install the system; (4) provide necessary operations training; and (5) provide documentation for operation, reporting, and evaluation. Progress to date is described.

24269 (DOE/CH/10093—6, pp 314-315) **Pressure steam drying of hardwood biomass for fuel.** Mitchell, P.H. (Mississippi Forest Products lab., Mississippi State). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The use of superheated steam to dry particles of selected hardwood will be evaluated in terms of (1) the rate of drying, (2) the quality and amount of recoverable energy, and (3) the effect the drying process has on the biomass fuel value. The major task areas are identified as (1) determination of the drying rates of four hardwood species (yellow poplar, red oak, sweetgum, and hickory), using four drying temperatures and three particle size classifications; (2) calculation of the potential recoverable energy in exhaust steam; (3) measurement of the pH of the steam condensate; and (4) calorimetric determination of the biomass higher heating value (HHV). The average drying rate (percent moisture content loss divided by drying time) is more representative of the speed at which a batch of chips dries (than drying time). Drying rate is largely affected by temperature, somewhat by species, and by chip size to a lesser degree. HHV values were 8345 Btu/O.D. lb at 150°C; 8489 Btu/O.D. lb at 175°C; and 8771 Btu/O.D. lb at 200°C. The HHV of pressure steam dried material appeared to differ little among species. As a result of pressure steam drying at 200°C, there was a 5% increase in the HHV of all species. The steam condensate collected is more acidic when collected from chips dried at the highest temperatures. The pH of condensate from chips dried at 200°C averaged 3.22 while that of chips dried at 150°C averaged 3.85.

24270 (DOE/CH/10093—6, pp 320-321) **Information guide for residential use.** Culbreth, C.D. (North Carolina Dept. of Commerce, Raleigh). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The North Carolina Citizens Group has surveyed a representative sample of North Carolina households concerning wood heating. According to survey results, one out of every four North Carolina households (27%) currently uses a wood stove to supply at least some of the heat for their homes. This represents 16%, or approximately 330,000 households, using wood as their main heating fuel. Survey results show that in households where the wood stove was the main source of heat, 72% were freestanding stoves and 28% were fireplace inserts. Most wood stoves were installed by the homeowner or a friend on a do-it-yourself basis (72%), and 28% were professionally installed. An information booklet is needed to address this growing market segment. This project is designed to achieve the following: (1) produce a document that provides an information source for the residential wood fuel user that will help inform them of the systems available, who makes them, how to operate and install them efficiently and safely, and how to maintain them; and (2) conduct a systematic survey regarding the facilities and experience of existing users and to systematically collect, automate, and publish information regarding wood fuel users. This information will be extremely valuable to potential users of wood fuel.

24271 (DOE/CH/10093—6, pp 322-323) **Evaluation of systems for harvesting, transportation, and combustion of wood for use in agricultural and commercial applications.** Jahn, L.G. (North Carolina State Univ., Raleigh). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

This project has the following (1) to study the cost and operating characteristics of different wood harvesting methods for roundwood and chips; (2) to study the cost and operating characteristics of wood transportation and material handling systems; (3) to study the cost and operating characteristics of wood-fired batch systems versus systems fired automatically and continuously; (4) to study the cost-effectiveness of using roundwood versus chips; (5) to study the overall economics of wood-fired energy systems; and (6) to develop economic and technology guidelines on the different types of operating systems. The approach will be to (1) review lit-

erature for agricultural and commercial applications less than 10 million Btu/h; (2) personally contact equipment suppliers of agricultural and commercial applications less than 10 million Btu/h; (3) visit and evaluate operations currently utilizing wood in agricultural and commercial applications to document the system and economics; and (4) prepare wood energy guide and provide guidelines for different operating systems. Progress to date is described.

24272 (DOE/CH/10093—6, pp 328-329) **Waste-to-energy project - generating hot water at South Carolina Criminal Justice Academy.** Thompson, R.L. (South Carolina Energy Office, Columbia). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

All law enforcement personnel in South Carolina are trained at the South Carolina Criminal Justice Academy. Approximately 300 trainees are housed in the dormitories throughout the year. Approximately 6000 gallons of hot water are used daily in the dormitories and kitchen of the academy. This water is currently provided by two 500-gallon gas water heaters. The facility also generates about a ton of garbage and trash daily that has to be hauled daily to a landfill by a private hauler. The objective of this project is to utilize the garbage and trash generated at the facility to heat the hot water needed daily. An incinerator will be installed designed to burn the garbage and trash. The incinerator will be equipped with a heat recovery unit to heat water. Also, a storage tank for the hot water will be provided. Engineering work has been completed; construction will start soon.

24273 (DOE/CH/10093—6, pp 330-331) **Greenhouse heating conversion project.** Lambrecht, E.G. (South Carolina Forestry Commission, Columbia). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

An installation is to be made to existing heat systems of two gutter connected greenhouses located at the Forestry Commission's Creech Forest Tree Seed Nursery in Sumter County near Wedgefield, South Carolina. The primary purpose of this capital improvement is to retrofit wood fired furnaces to four heat exchangers of existing greenhouse heating ducts. Two hydronic stick wood fired heaters (ganged together) have been installed on a cement slab approximately 50 ft from the greenhouse. The heaters have design capacity of 360,000 Btu/h. The furnaces were tested for 15 weeks beginning on January 1, 1985, and are working successfully. Records on fuel costs of producing the wood are compared with propane cost in fiscal 1984.

24274 (DOE/CH/10093—6, pp 332-333) **Establishment of a wood-coal fuel demonstration program in Tennessee.** Hensley, B. (Tennessee Dept. of Economic and Community Development, Nashville). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Recent research has shown that co-combusting in industrial boilers can significantly reduce air pollutant emissions. The major project objective is to develop an economical and technically feasible wood-coal fuel demonstration program for Tennessee's commercial and industrial businesses. The overall program will be developed in two phases over a two-year period. First year program objectives include compiling a list of major Tennessee fuel burning installations with wood and/or coal burning facilities, a woody biomass resources and wood waste directory by county, and air emissions data by county or community; identifying the best candidates for switching to coal-wood fuel mixtures; and reviewing and establishing any state wide incentive program necessary to make a possible fuel switch more attractive (i.e., emissions offsets, trading, etc.). System installation and demonstration are anticipated for the second program year.

24275 (DOE/CH/10093—6, pp 340-341) **Analyzing market constraints in woody biomass energy production.** Ostermeier, D.M. (Univ. of Tennessee, Knoxville). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

There are three objectives in the study: (1) to identify competitive wood energy market segments; (2) to identify market and institutional barriers to industrial and institutional wood energy production; and (3) to analyze methods of modifying existing constraints. Four activities are used to complete the objectives: (1) an intensive literature review to identify the most cost-competitive markets, and a survey to determine the energy market segments that have adopted wood energy; (2) a survey of energy users with a strong competitive advantage outside the study area (i.e., Southeastern US) and a survey of energy users inside the study area to identify constraints to wood energy production; (3) statistical analysis of survey results to determine statistically valid market, institutional, and location constraints; (4) use of the survey results and intensive literature review to identify appropriate private and public policies to encourage wood energy use.

24276 (DOE/CH/10093—6, pp 352) **Catalytic gasifier/combustor for biomass fuels.** Jaasma, D.R. (Virginia Polytechnic Institute and State Univ., Blacksburg). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project objectives are to (1) quantify the conditions under which fuel-rich combustion products can be generated from several biomass fuels, (2) design a combustion control strategy that uses regulated air flows and catalytic combustion, (3) implement the control strategy at the prototype level, (4) implement the control strategy on a 700,000 Btu/h level, and (5) evaluate the exhaust emissions of the 700,000 Btu/h system. The prototype combustor tests using cordwood, corn residues, and baled slash are completed. A 700,000 Btu/h boiler was installed, instrumented, and operated on wet cordwood, dry cordwood, and chicken litter. The boiler has been modified to include oxygen sensing and secondary air control. The emission measurement and air control systems are being automated. The modified system was tested to determine its ability to operate on a range of fuels.

24277 (DOE/CH/10093—6, pp 353-354) **Investment decision-making guide for biomass energy installations.** Sinclair, S.A. (Virginia Polytechnic Institute and State Univ., Blacksburg). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Previous studies on the feasibility of biomass energy conversions and new installations, as well as a series of wood energy meetings conducted by the Forest Products Research Society, have provided much background work in this area. The workbook will develop an investment decision-making exercise that current managers can perform to determine the feasibility of biomass energy usage for their particular situations. This guide will be applicable to companies considering initial installation of an energy system, retrofitting a conventional system to accommodate biomass fuels, and the replacement of an existing fossil-fueled boiler with one that burns biomass. Additionally, this workbook will examine the feasibility of a biomass-fueled steam/electricity cogeneration facility as a new installation option for small-to-medium-sized firms. The workbook entitled Biomass Energy Systems: An Investment Decision-Making Guide for the Small Business, is currently being prepared for field testing. Input from the business education editor should provide useful insight as to the readability and ease of use by the intended audience. A complementary manual entitled Resource Manual of Financing Options for Biomass-Fueled Systems discusses financial options available for investors in biomass energy systems.

24278 (DOE/CH/10093—6, pp 355-357) **Feasibility of cogeneration using mill waste at West Virginia sawmills.** Brock, S.M. (West Virginia Univ., Morgantown). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is specifically designed to accomplish the following: (1) identify for case study purposes sawmills in West Virginia and adjacent states using cogeneration; (2) obtain permission from sawmills identified as using cogeneration to produce case studies; (3) estimate relevant cost/return information for the actual cases and for eight hypothetical cases representing four sawmill size classes; and (4) develop a model for evaluating the profitability of investments in mill-residue fueled cogeneration facilities with dry kiln capacity. An extensive review of available literature on existing biomass energy cogeneration facilities was made and used to help formulate an economic model for evaluating investments for this study. Three studies were made of actual cases: one each in Pennsylvania, Virginia, and Kentucky. To obtain information for the hypothetical studies, equipment manufacturers were surveyed by telephone for data on costs of equipment needed for cogeneration and fuel use. This information was obtained for 15, 10, 5, and 1 million board feet sawmills, spanning the sizes found in operation in West Virginia. Results are described.

24279 (DOE/CH/10093—6, pp 358-359) **Biomass system for space and process heat.** Hayes, W.A. (Young's Furniture Manufacturing Co., Inc., Whitesburg, TN). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Installation of a wood waste boiler to provide both space and process heating needs at this furniture manufacturing company will create a highly visible demonstration of the effectiveness of this technology to the many similar furniture manufacturers and other wood products companies in Tennessee, Virginia, and North Carolina. Objectives include (1) replacement of existing oil furnace space heating system for manufacturing area; (2) replacement of electric heat pump for office space heating; (3) addition of heating capacity to handle 9600 square feet of new manufacturing space; and (4) addition of enough heating capacity to handle two wood drying kilns with a capacity of 50,000 board feet of lumber each. The new heating system will be capable of using available wood waste as a source of fuel, thereby demonstrating reduced overall operating costs and advantageous payback period. A centralized energy system was designed that will provide space heating for all old and new manufacturing areas and offices, and also provide enough excess capacity for future drying kiln operations. This system will use a 60 horsepower wood waste boiler capable of operating with existing manufacturing residues of about 900-1000 tons/yr. Equipment, its installation and performance are described.

0905 Liquid Waste Fuels

24280 **(CFI—8203) Market survey of pressure vessels for synthetic fuel production systems. Final report.** (Chinook Fuel Innovations Ltd., Calgary, Alberta (Canada)). Mar 1982. 325p. (MICROLOG—83-0917). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The Canadian demand for crude oil during the coming two decades will likely be supplied from conventionally produced crude oil, upgraded heavy oil, and oil products from oil sands projects. Vast Canadian coal reserves could add to the supply in the form of liquid products and gaseous fuels. These upgrading and conversion technologies operate at pressures of 15,000 kPa (2,000 psi) and more, temperatures of 800/sup 0/C (1500/sup 0/F) and higher, and atmospheres with hydrogen content of 1% and up. Process requirements and economics dictate the size of the primary and secondary reactor vessels. The reactors are of very thick wall. An evaluation to the year 2000 for such heavy wall pressure vessels in the hydrocarbon conversion industries was needed to identify potential opportunities in the field and embark on research and development programs for improving fabrication technologies and assisting industrial fabricators. The forecast evaluated the demand for pressure vessels of 63mm and thicker wall for those energy projects in the forecast period. The likely process technologies for the next twenty years were identified and their heavy wall pressure vessel requirements for particular plant sizes determined. From this, heavy wall pressure vessel procurements were derived. An overview evaluation of the Canadian capabilities of steelmakers and vessel fabricators was carried out. Further identified were material requirements and technological gaps in fabrication capability and Canadian steel supply.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 24536, 24549

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 24049, 24062, 24214, 24215, 24218, 24219, 24220, 24221, 24222, 24223, 24224, 24225, 24226, 24227, 24228, 24229, 24232, 24233, 24234, 24238, 24239, 24240, 24241, 24242, 24243, 24244, 24245, 24246, 24247, 24248, 24249, 24250, 24251, 24252, 24253, 24254, 24255, 24256, 24257, 24258, 24259, 24260, 24261, 24262, 24263, 24264, 24265, 24266, 24267, 24268, 24269, 24270, 24271, 24272, 24273, 24274, 24275, 24276, 24277, 24278, 24279, 24577, 24578, 25008, 25009, 25070, 25071

24281 **(BCR—2/03/539) Supercritical extraction of poplar wood in a continuous system.** Jezko, J.; Howard, J. (B.C. Research, Vancouver (Canada)). Mar 1984. 28p. (MICROLOG—87-05219). Bioenergy Development Program. Renewable Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Continous supercritical extraction of poplar wood at 360/sup 0/C and 20 MPa pressure and similar extraction with hydrogen addition were successfully carried out using the B.C. Research continuous coal liquefaction unit. Dependable delivery of methanol wood slurry to the high pressure reactor was a serious problem during the initial stage of this investigation. It was solved by streamlining feed lines and diluting the slurry to 5 weight percent wood. The respective yields of liquid products isolated were 70 and 51% based on dry wood while the yields of gas were 6 and 31% and water were 3 & 1%. Conversions of 93-94% based upon ash balances showed no significant differences due to hydrogen addition. Limited material balance data of 94 and 83% were insufficient for accurate economic evaluation of the process. The products showed significant chemical and physical differences. The hydrogen:carbon ratio decreased from 1.52 to 1.44 with hydrogen addition, while the viscosity increased and the methoxyl contend decreased. Thermogravimetric data showed that hydrogen addition decreased volatility in the 100-400/sup 0/C range. However, neither densities, nondistillable residues, nor heating values were significantly affected by hydrogen addition.

24282 **(BNR—8203) The preparation and characterization of TiO/sub 2/ thick film photoanodes for applications in photoelectrochemical cells. Final report.** Blaauw, C.; Naguib, H.M. (Bell Northern Research Ltd., Ottawa, Ontario (Canada)). Mar 1982. 97p. (MICROLOG—83-2108). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This work examines the feasibility of fabricating screen-printed thick film photoanodes and their properties for use in photoelectrocemical (PEC) cells. TiO/sub 2/ thick film pastes were prepared dispersed in a liquid organic vehicle. The films were screen printed on gold-metallized alumina substrates and air-fired belt in a conveyor furnace temperatures 600-900/sup 0/C. The photoanodes were then heated in ammonia or hydrogen atmospheres at temperatures in the range 400-900/sup 0/C. The films were characterized by scanning electron microscopy, x-ray diffraction, x-ray fluorescence, nuclear microanalysis, elastic recoil detection, proton-induced x-ray emission, and electrical resistivity measurements. A number of impurities were detected. The use of ammonia as a reducing agent produced films with a high concentration of oxygen vacancies and lower oxides with metallic properties resulting in poor PEC characteristics and low solar conversion efficiencies. Film reduced in hydrogen at 700/sup 0/C showed a minor compositional change and yielded solar energy conversion efficiencies of 2.5-3.0%. This is 40% higher than the corresponding efficiency ob-

tained from rutile single crystal electrodes reduced under the same conditions. The hydrogen-reduced thick films exhibited larger absorption of light energy in the long wavelength region.

24283 (BU/P—810701) **Preparation and development of semiconducting TiO/sub 2/ films for photoelectrolysis of water: preparation and characterization of metal oxide electrodes. Final report.** Koffyberg, F.P. (Brock Univ., St. Catherines, Ontario (Canada). Dept. of Physics). 1 Jul 1981. 32p. (MICROLOG—82-1555). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objective of this work was the preparation of ternary rare-earth transition-metal oxides of the type LaX0/sub 3/ (X=Co,Cr,V) and the subsequent measurement of their properties as photoelectrodes for the solar photoelectrolysis of water. The overall effort was divided into the stages of: synthesis both undoped and doped with Strontium, Titanium and Thorium by high-temperature sintering; structural characterization of the samples by X-ray diffraction; electrical characterization of the samples by measurements of their resistivity and thermoelectric power; evaluation of their characteristics as photoelectrodes; preliminary evaluation of electrode stability.

24284 (DOE/CH/10093—6, pp 221) **State technical assistance grant [Oregon].** Marsh, G.W. (Oregon Dept. of Energy, Salem). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Six on-going core functions are performed by the states as part of their involvement in the Pacific Northwest and Alaska Bioenergy Program. They are (1) participate in Policy Group and Task Force meetings and related activities; (2) prepare state annual operating plans and multi-year programs; (3) implement interagency coordination of program and resource development activities on the state level; (4) serve as a focal point for biomass energy system applications information technology transfer to the public, legislators, private industry, and local agencies and government; (5) prepare assessments of potential biomass-fueled targets of opportunity within the state's industrial commercial, and public institution sectors; and (6) develop and provide an annual update of available state biomass resource base. The Oregon Department of Energy has identified four key areas to pursue, which includes the development of the following: (1) an inventory of existing biomass-fired boilers, which will focus on energy use in the wood products industry; (2) an assessment of biomass fuel targets; (3) a wood residue resource assessment; and (4) determination of the feasibility of a mobile wood residue-fired power generating plant.

24285 (DOE/CH/10093—6, pp 223) **Study of comparative yields of 35-year-old Douglas fir and associated species on paired, burned and unburned plots in western Washington and Oregon.** Miller, R.E. (Forest Service, Olympia, WA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Measurements and comparisons of stand yields on existing burned vs. unburned side-by-side plots will be made by species and diameter classes. Based on existing photographic and transect records, estimates will be made on the above ground quantity of biomass and nitrogen destroyed or retained on these plots after slash burning. All available information on the locations was documented and inventoried. Samples (plot surveys and tree measurements) were taken on 30 plots in the western portion of Oregon and Washington ranging in size from 0.2 to 0.7 acre. The data gathered in this sampling operation are being prepared for analysis. These tree data and other variables will be summarized in a form convenient for statistical analysis.

24286 (DOE/CH/10093—6, pp 224) **Forest biomass in five Western states.** Howard, J.O. (Forest Service, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of this project is to describe the wood biomass resource in southeast Alaska, Idaho, Montana, Oregon, and Washington. In addition to the regional assessment, two special wood energy supply situations will be described: (1) current conversion opportunities for logging residue and (2) whole-tree harvesting of small diameter stands. Sources and assumptions needed to develop whole tree biomass tables will be identified. Tabular biomass data will be presented for 14 geographic areas in the Pacific Northwest and Alaska. Significant highlights and relationships of the regional resources will be shown in a series of graphs and charts. Data collection has not yet begun.

24287 (DOE/CH/10093—6, pp 225) **Assessment of logging residue in southeast Alaska.** Howard, J.O. (Forest Service, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The study will develop factors that relate cubic foot volume of residue resulting from 1000 board feet and per acre of timber harvest and will provide estimates of average volume of residue by characteristics affecting potential recovery. Measurements of logging residue will be taken on 60 randomly selected clearcut harvested areas in southeast Alaska. To account for expected variation in residue factors, the area is separated into two strata based on land ownership. Residue measurement is accomplished by the line intersect method, with subsampling for piece characteristics. Initial field efforts were directed at testing the study design. Data collection has been completed for one-third of the sample units.

24288 (DOE/CH/10093—6, pp 227) **Biomass estimation, costs, and impacts of converting stands.** Howard, J.O. (Forest Service, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW. Contract AI79-84BP17609.

In Biofuels and municipal waste technology research program summary: FY 1986.

On-the-ground exams, aerial photos, and soil type maps were used to identify study sites. Six sites, with stocking levels ranging from 1000 to 2000 stems per acre, were located on two different chosen watersheds. Western hemlock, Douglas fir, and western red cedar were investigated. Downed material and standing trees were inventoried. Groups were formed for species, dead or living, and 1 in. dbh classes. The falling procedure included crown removal, measuring stem type and bark thickness, sample disk removal, determination of stem weight, and laboratory processing of samples. While the results of this study are not necessarily applicable to other doghair stands, the information can provide a basis for characterization and evaluation. Stocking levels were found to be highly variable. A large portion of each stand was made up of dead trees with overall small diameter classes. Predictive equations were developed for estimating weight and volume. High biomass production was not necessarily the result of densely stocked doghair stands. The accumulation of weight concentration in high stem count areas is significantly less than that generated in stands with low stem density where biomass is in fewer but larger trees.

24289 (DOE/CH/10093—6, pp 228) **Impacts of residue removal on nitrogen loss.** Little, S.N. (Forest Service, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Eleven cable-yarded clearcuts were set up as treatment blocks in Oregon and Washington. The units consisted primarily of Douglas fir and western hemlock slash. Duff depth ranged from 3.1 to 17 cm. The units covered a range of fuel biomass under various levels of harvest in Oregon. The units in Washington were designed to concentrate on altered moisture conditions prior to burning. Pre- and post-burn measurements were devised to determine woody biomass, biomass consumption, duff depth reduction, and moisture content of the fuel and duff. The data collected were insufficient to predict average nitrogen loss from prescribed burning. Estimating average nitrogen loss is difficult due to the variability in nitrogen

concentration within a unit because of the wide variety of duff types and, from unit to unit, different stand histories. It is suggested that nitrogen loss from prescribed burning can be alleviated by large fuel removal and/or by burning when moisture content is high. To estimate nitrogen loss from duff consumption, the researchers recommend sampling for nitrogen consumption in the duff and multiplying expected duff consumption by the average nitrogen concentration.

24290 (DOE/CH/10093—6, pp 231) **Recovery of forest residues.** Johnson, L.R. (Univ. of Idaho, Moscow). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

After conventional harvest systems tests for optimum recovery of wood wastes for firewood or hog fuel were conducted, a Clearwater yarder was tested on steep slopes and a Lucky Logger on gentle slopes. Each was combined with a firewood shear and grinder used either during or after harvesting. The test plan included establishing (1) economic limits for equipment and recovery distance, (2) cost and production data, (3) methods of estimating landing pile residue quantities, and (4) comparisons to conventional residue disposal. The shear was capable of handling a wide variety of size and condition in the residue. On-site grinding is more expensive than shearing and does not provide any great benefits in handling or transportation. The grinder used was limited in the piece size it could accommodate. Hot processing operations (yarder or skidder hauling directly to the loader and shear) are more expensive than could decking operations. Considering landing space limitations, a combination of hot processing with cold decking may be the best option. Overall, it was found that there may be areas where a concurrent recovery and processing system would be economically feasible, particularly if firewood is in high demand.

24291 (DOE/CH/10093—6, pp 232) **State technical assistance grant [Washington].** Kerstetter, J.D. (Washington State Energy Office, Olympia). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

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24292 (DOE/CH/10093—6, pp 234) **Residue recovery, transport, densification, and storage economics.** Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The system(s) chosen by the contractor will address four phases of forest residue recovery: harvesting, transportation, load densification, and storage. The system(s) will be subjected to a thorough economic and sensitivity analysis (using a developed or documented economic methodology) to determine its advantages and disadvantages when compared to other systems including conventional residue processes/procedures. The study will also address special areas of concern related to infrastructure development or institutional factors affecting operations. A comprehensive case study will document the results of the economic analysis.

24293 (DOE/CH/10093—6, pp 235) **Forest residue recovery and biomass marketing demonstration.** Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

An existing or to-be-developed biomass marketing effort will be selected using a study methodology chosen by the contractor. The demonstration and documentation of the activity will include (1) moving sufficient biomass to demonstrate the economic feasibility of wood-for-energy, (2) an analysis of the operation's economics and the range of processes/procedures required to use the residue resource in the energy market, and (3) an account of problems encountered and solutions to the problems.

24294 (DOE/CH/10093—6, pp 236) **Biomass recovery system for remote Alaska.** Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Remote areas of Alaska lack access to current knowledge and information about economic development opportunities in nontechnical industries, such as harvesting and marketing. Moreover, in some remote areas with abundant wood resources, diesel fuel ($1.30 to $2.50/gal) is used for residential heating. Wood and its byproducts could prove to be competitive with diesel fuel. A developed or documented methodology for determining the nature of the problem and for selecting candidate systems suitable for this area will be chosen by the contractor. Systems for harvesting, transporting, and marketing of biomass (firewood) products for local and regional use will be selected with a view to demonstrate the economic feasibility of biomass production and utilization. Calculations will include capital, operation, and maintenance costs for both the chosen system(s) and comparative systems. Native lifestyle and culture will be considered in the development of any system as will many other potential issues such as current forest management practices. A case study will be used to document the findings. The information developed in this study will be used to establish a data base, which may be of potential use for small business in the area.

24295 (DOE/CH/10093—6, pp 242) **Wood resource accessibility assessment.** King, H.T. (Council of Great Lakes Governors, Madison, WI). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Policy makers in the Great Lakes region currently do not have access to information detailing the amount of wood available for energy at the county level. Utilizing data collected by the US Forest Service, an assessment will be performed to determine the volume of wood available for energy from the following classes of timber: (1) dead trees, (2) cull trees, (3) growing stock trees, and (4) trees 1 to 5 in. in diameter. The accessibility of the timber will be judged by its proximity to roads and its location on varying degrees of slope. A publication will be prepared that indicates in a table format the volume of wood available by class, by proximity to roads, and by slope. Two computer programs were written to access US Forest Service data bases and format results of accessibility calculations. Computer runs were made using the two programs, and the data are currently being compiled.

24296 (DOE/CH/10093—6, pp 243-244) **Economic analysis of the impacts of increased biomass energy utilization in the Great Lakes states.** Anderson, M. (Employment Research Associates, Lansing, MI). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

An analysis will be performed to estimate the regional and state economic impacts resulting from increased biomass energy use during the period 1985-1995 in the Great Lakes region. The focus of the assessment will be on the changes in jobs, income, and tax revenues resulting from the substitution of indigenous biomass fuels for conventional fuels. A series of estimates and projections will be made including (1) current and projected energy use by sector, by fuel type, and by state; (2) biomass feedstock availability by state;

and (3) biomass conversions by feedstock and by state. These figures will be incorporated into a modified macroeconomic I/O model called IMPLAN developed for the US Forest Service. The model will provide an indication of the income, employment, and tax base changes that would result from increased substitution of biomass for nonrenewable imported energy resources. A summary of the research findings will be distributed to public and private decision-makers throughout the Great Lakes region. Results indicate that more than 32,000 people were employed in the biomass industry in the Great Lakes region in 1985. Under a modest biomass energy growth scenario, these permanent jobs may grow to between 70,000 and 100,000 jobs by 1995. Savings from reduced energy imports may grow from $620 million in 1985 to between $1.1 billion and $1.5 billion in 1995. State tax revenues from biomass energy sources will average between $43 million and $57 million annually over the next 10 years.

24297 (DOE/CH/10093—6, pp 247) **Illinois state grant.** Miller, T. (Illinois Dept. of Energy and Natural Resources, Springfield). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of the project is to combine biomass research, development, and information activities into a program that will accelerate the commercialization of biomass technologies and fuels in the state of Illinois. Activities to be undertaken by the Illinois Department of Energy and Natural Resources (ENR) include (1) publishing four biomass energy articles in the Energy Alternatives newsletter; (2) providing tours, workshops, and demonstrations of biomass energy use in Illinois; (3) compiling abstracts of biomass energy research and development in Illinois; and (4) providing private sector and university researchers with access to the DOE RECON data base. The ENR has conducted a workshop at the University of Illinois Department of Mechanical Engineering to transfer to the private sector research results on the use of alcohol fuels in diesel engines, compiled abstracts on biomass research being conducted in Illinois, and completed a research project on short-rotation woody biomass.

24298 (DOE/CH/10093—6, pp 250) **Short rotation forestry workshops.** Wood, E. (Meridian Corp., Falls Church, VA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Some landowners in the Great Lakes region are interested in planting fast-growing trees species, but they do not have a source of reliable information on the proper cultivation techniques. While an extensive amount of research has been done, the results are not widely known by either land management professionals or landowners. Seven one-day workshops on short-rotation forestry will be presented to forestry and land management professionals in the Great Lakes region. The workshops will be oriented toward those state and federal government agencies that answer landowner questions on a daily basis. The workshops will be conducted in each of the seven Great Lakes states for personnel in the US Soil Conservation Service, US Cooperative forestry offices, state agriculture offices, county forestry offices, and other interested professionals.

24299 (DOE/CH/10093—6, pp 255-256) **Economic aspects of biomass production alternatives on marginal land.** Campbell, G. (Univ. of Illinois, Urbana). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The extent of marginal lands in the Great Lakes region will be identified and classified for the purpose of feedstock production and harvest. Barriers to production, landowner attitudes, and ownership patterns will be defined through existing data and a sample survey. An economic analysis will be performed on herbaceous and short-rotation systems based on the costs of production and existing markets for replacement fuels. The results of the projects will permit recommendations to be made for each biomass feedstock system in relation to site factors, production levels, costs, end-product prices, and landowner characteristics. The full-scale survey of landowner attitudes has been conducted, and the final report summarizing the survey has been printed. The economic analysis of biomass production from short-rotation and herbaceous crop systems has been finalized, and maps and tables indicating characteristics and acreage of marginal lands in the Great Lakes region have also been completed.

24300 (DOE/CH/10093—6, pp 258) **Environmental impacts of harvesting wood for energy.** Johnson, J. (Univ. of Wisconsin, Stevens Point). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Policy makers in the Great Lakes region are reluctant to fully endorse wood energy use because they are unsure of the potential environmental effects related to wood harvesting. While a great deal of research has been done on the topic, the results have not been published in easy-to-read documents. A guidebook will be produced for policy makers on the environmental impacts of wood harvesting for energy. The guidebook will be written in a non-technical style and will summarize the research that has been conducted on wood harvesting in northern deciduous and northern deciduous-coniferous forests. The harvesting techniques that will be examined include various magnitudes of pre-commercial thinning, integrated harvesting, post-logging residue recovery, and small landowner logging. The guidebook will be distributed to legislators and state government officials throughout the Great Lakes region.

24301 (DOE/CH/10093—6, pp 259) **Impact of large biomass demand centers on the resource base.** Donovan, R. (Associates in Rural Development, Burlington, VT). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The US Department of Energy is sponsoring four Regional Biomass Energy Programs to effectuate the transfer of information developed by other projects in the Biofuels and Municipal Waste Program. The research component of these programs develops regionally specific information to further conversion to biomass technologies. The objective of this project is to examine the impact of large biomass demand centers on forest management practices and wood fuel supply. The following elements of supplying fuel to four large demand centers in the northeast region were compared: fuel procurement systems, categorization of landowners who supply fuel, types of fuel suppliers, harvesting methods, and the use of professional foresters.

24302 (DOE/CH/10093—6, pp 267) **State grant - Connecticut.** Sartori, M. (Office of Policy & Management, Hartford, CT). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The purpose of Connecticut's third year NRBP program is to help encourage conversion to biomass use by overcoming public perception of the total amount of available materials. The program will assess the annual amounts of woody biomass material available in each Connecticut county; publish a booklet summarizing these findings and describing how to use these findings in determining potential impacts of proposed biomass conversions; and distribute the report to potential industrial converters, local planning and zoning organizations, county CRD agents, and other appropriate audiences.

24303 (DOE/CH/10093—6, pp 268) **State grant - Delaware.** Cordell, R. (State of Delaware Forestry Section, Dover). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives are to provide the opportunity for the citizens of Delaware to gain information and knowledge in wood/biomass energy technologies, to enhance the quality and productivity of Delaware's forest resource base, and to improve the image of wood/biomass as an alternative energy source. The program will conduct a demonstration project on wood lot management for fuel,

conduct a preliminary investigation of whole-tree chipping and the potential in Delaware and engage in a program of technology transfer, information dissemination, and promotion. Under this general heading, the program will distribute informational material; conduct or promote workshops, seminars, and conferences; and offer preliminary analyses for wood conversion to potential industrial/commercial firms.

24304 (DOE/CH/10093—6, pp 269) **State grant - Maine.** McConnell, M. (Office of Energy Resources, Augusta, ME). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective is to implement a multi-faceted program designed to promote the responsible use of wood energy in Maine. The grantee will complete negotiations for the conversion of a state facility to wood energy. A data base of all regulated boilers in Maine will be established. At least ten businesses/institutions will be assisted in converting from fuel oil to biomass systems through cost-shared feasibility studies. The subgrantee will also complete a computerized reaggregation of forest resources for more accessible inventory data retrieval and provide at least four site demonstrations of chipping and related forestry operations for loggers, foresters, and landowners.

24305 (DOE/CH/10093—6, pp 270) **State grant - Maryland.** Baxter, D. (Dept. of Natural Resources, Annapolis, MD). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective is to continue and expand the state's program to encourage the use of wood as a fuel for its industrial firms in a manner consistent with the State of Maryland's environmental objectives. Enhancement of Maryland's forest and forest products industries will continue as a focus. The program consists of the following tasks: identify more than 100 businesses with good potential for conversion to wood energy; initiate educational efforts designed to stimulate interest in wood energy conversion by businesses; prepare a Maryland Wood Energy User's Guide; continue and expand efforts to provide financial and engineering assistance to firms interested in using wood energy; and instigate the formation of a mid-Atlantic wood energy association.

24306 (DOE/CH/10093—6, pp 271) **State grant - Massachusetts.** Sacks, I. (Executive Office of Energy Resources, Boston, MA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives of this project are: to assist selected businesses and institutions to assess the technical and economic feasibility of utilizing wood fuel and solid waste; to determine the biomass energy potential of publicly owned facilities as well as facilitating the installation and/or siting of biomass and MSW facilities owned by the public; and to promote a more stable and extensive wood fuel supply infrastructure. The approach has been to follow up with firms that have responded to earlier conversion outreach programs through the WEAP and AEPP programs; identify municipal conversion candidates; and work with the Massachusetts Department of Corrections to install a wood energy system at the Warwick Correctional Facility. Subgrantee is continuing outreach efforts through the WEAP and AEPP programs. The survey of potential resource recovery facility sites is continuing. Installation at the MCI - Warwick facility is still not completed.

24307 (DOE/CH/10093—6, pp 272) **State grant - New Hampshire.** Schondelmeier, R. (Governor's Energy Office, Concord, NH). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective is to encourage industries, small businesses, institutions, and homeowners to convert to biomass fuel, especially wood. Firms will be identified with the greatest potential for converting to biomass and provided with the information needed to begin to make an informed decision on the economic feasibility of conversion. This information includes economic analyses performed by a computer and guidance in finding engineering firms with the background and expertise necessary to design a biomass system. The project will also develop strategies to encourage the safe use of chunk wood, chips, and pellets in the residential sector.

24308 (DOE/CH/10093—6, pp 273) **State grant - New Jersey.** Lempicki, E. (Dept. of Environmental Protection, Trenton, NJ). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of the program is to encourage the conversion of public and private facilities to biomass power. The State will continue its Industrial Wood Energy Conversion Assistance Program. The program will contact and provide information to potential converters. A public facility will also be identified for possible conversion. The program will provide detailed information to potential converters and maintain data on wood residue supplies. The cost of landfilling has created tremendous pressure for alternatives. Power generation is one of the alternatives that has been extensively utilized. The subgrantee is constantly involved with developers and industrial/commercial firms taking their first steps into the wood energy field. As a result, the planned public facility project has been delayed until next year.

24309 (DOE/CH/10093—6, pp 274) **State grant - New York.** Peterson, J. (New York State Energy Research and Development Authority, Albany). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective is to promote the rational use of wood for energy by aiding the prospective user in assessing the economic benefits of conversion to wood fuel, identifying sources of suitable equipment, and locating available wood supplies. The program consists of the following tasks: address perceptual problems with wood energy through interaction with industrial decision-makers on a site-specific basis; expand on an existing program of providing energy conservation audits to business by training additional advisors to perform on-site surveys and feasibility studies of wood conversions at small- to medium-size industrial and commercial facilities and develop a series of case studies to make the case for wood energy in New York. Thirty surveys have been performed this year under the W-EASI program.

24310 (DOE/CH/10093—6, pp 275) **State grant - Pennsylvania.** Szabara, P. (Dept. of Environmental Resources, Harrisburg, PA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives are to increase the use of wood as an energy source, particularly in the industrial sector, while improving the state's forest resources and to improve the effectiveness and coordination of state agencies with wood energy-related responsibilities. The state will operate a clearinghouse of lists of producers and consumers of wood energy fuels, hardware, and services. This will be published as part of the Pennsylvania Marketing Bulletin. The state will also provide information to potential converters on various financing options as well as technical issues. The state also plans to complete a survey of primary wood processors. The program has been involved in the siting of at least five industrial wood energy systems in the past year. The program is continuing outreach efforts to potential converters and continuously updating its information base. Forms for the survey of primary wood processors have been prepared and circulated.

24311 (DOE/CH/10093—6, pp 276) **State grant - Rhode Island.** Ericson, B. (Governor's Energy Office, Providence, RI). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives are to increase the use of indigenous wood energy resources and develop a healthier, more productive forest resource by educating landowners and homeowners, providing information to large energy users about direct combustion and cogeneration of wood, and developing potential markets for biomass utilization. The program consists of the following tasks: produce a videotape on wood lot management targeted to landowners for use in a workshop series; conduct a survey of fuel wood consumption during the 1985-86 heating season; update a wood stove safety guide, which is distributed to all wood stove purchasers in the state; conduct a prefeasibility analysis for the installation of a cogeneration project at the state medical center; and continue to track electric utility rates, PURPA buy-back rates, and wood chip prices. A final project will develop case studies on 1 MW stick-wood-fired boilers for small industrial applications.

24312 (DOE/CH/10093—6, pp 277) **State grant - Vermont.** Hudson, N. (Dept. of Public Service, Montpelier, VT). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objectives are to expand the use of wood energy chips in all sectors and to specifically promote new technologies - chip and pellet burning - that offer a more convenient, clean, and efficient method of wood burning. Two surveys will be conducted, one of residential wood use in 1985-86 and a second, which will survey industrial wood users in the state. The subgrantee will also appear on at least three television programs promoting various aspects of wood energy, produce short videos on current wood burning technology and chain saw safety, and continue outreach to potential converters. Technical assistance will also be made available.

24313 (DOE/CH/10093—6, pp 286) **Resource manual of financing options for biomass-fueled systems.** Pennycooke, N. (Coopers & Lybrand, Atlanta, GA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The primary objective is to provide a clear, concise, and definitive publication on financing options for biomass energy systems. The intent is to provide this information to the consumer, typically an industrial or agricultural concern. The publication may also be useful to equipment vendors, bankers, and municipalities issuing industrial development bonds, and other parties involved in system implementation. Discussions about several key financing issues (and options) will be included, and each will be followed by a checklist of key points or questions that need to be addressed. Three major options will be documented: bank loans, leases, and industrial develop bonds. The advantages, disadvantages, and requirements of each option will be detailed, and a hypothetical example of a boiler unit with a capacity of 15,000 lb/h will be used. The action plan involves various tasks including bibliographical research, questionnaires, and interviews with commercial lending officers and lessors in various cities within the 13-state region.

24314 (DOE/CH/10093—6, pp 291-292) **Biomass energy workshops and feasibility study for a biomass association.** Draper, H. (Florida Governor's Energy Office, Tallahassee). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The biomass industry in Florida is extremely diverse, made up of energy wood producers and users, sugar cane bagasse users, ethanol producers and marketers, organizations producing methane from biomass and wastes, and solid waste-to-energy developers. The feasibility of a private sector association of biomass energy producers and users will be investigated through the organization of an invitation-only workshop on biomass energy technology and policy. It is expected that the workshop will provide opportunities to bring diverse biomass interests together to seek common strategies and common interests. The association would determine future biomass needs and provide an advisory function to policy makers in the state. A preliminary workshop for Chipola Junior College students will allow the completion of a biomass energy demonstration facility and teaching materials to promote biomass technology transfer.

24315 (DOE/CH/10093—6, pp 293-294) **Characterization of logging residue.** Loggins, T. (Georgia Forestry Commission, Macon). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A large proportion of the forest land in the Piedmont and Upper Coastal Plain of the Southeast is mixed pine-hardwood, and relatively more pine than hardwood is harvested for solid wood products and fiber. The residual trees must be felled, windrowed, and burned - a substantial monetary outlay - as part of the necessary site preparation for the regeneration of productive forests. Harvest of these residual trees for fuel would reduce site preparation costs as well as help meet the growing need for energy. The objectives of this project are: (1) define the parameters of initial stand composition and conventional product removals for which post-harvesting of residuals would be practical, (2) provide a system based on initial stand conditions for estimating recoverable energy wood with existing harvesting systems under current economic conditions or for future systems and economics, (3) develop a capacity to determine the type of operation and cost of the most efficient regeneration of harvested sites, and (4) develop a data base from which to derive engineering specifications for the development of more efficient recovery systems.

24316 (DOE/CH/10093—6, pp 303-305) **Louisiana biomass energy program.** Buchart, M. (Louisiana Dept. of Agriculture and Forestry, Baton Rouge). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is designed to achieve the following: (1) improve the coordination and capabilities of various Louisiana state agencies involved with biomass energy products and applications, (2) provide reliable information to users, (3) provide technology transfer to industry, (4) work to overcome obstacles to biomass development, and (5) promote the use of wood in the place of natural gas. A full-time staff position will be created in the Louisiana Department of Agriculture and Forestry, with responsibility to promote biomass energy and to work with SERBEP. Existing Louisiana conservation programs will be reviewed to identify potential cooperative activities. Meetings will be held with other Louisiana state agencies to identify opportunities for joint biomass energy projects. Current information will be provided to program managers in energy conservation areas. Press releases will be prepared and distributed publicizing examples of successful biomass energy applications. Industrial wood burning will be included as part of the Louisiana Industrial Conference. Louisiana Department of Commerce staff will be educated on the advantages of including biomass fuel sources when promoting Louisiana as a site for new industry. Information and referrals on specific biomass applications will be provided to potential and existing industrial biomass energy users. A subcontract will be administered through a Louisiana university to determine the long-term economics of the application of wood heat in commercial new construction and renovation.

24317 (DOE/CH/10093—6, pp 307-308) **Case studies of biomass energy facilities in the Southeastern region.** McKenna, R. (Meridian Corp., Falls Church, VA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A collection of 80 brief case studies will be produced, providing basic technical and economic information on successful producers and users of biomass fuels and biomass energy. The case studies will be produced as loose-leaf fact sheets and will be limited in length to both sides of a single sheet of paper. Information will be presented in both tabular and narrative form. The emphasis of this collection of case studies is diversity - of industry users, biomass fuel types, energy conversion system types, and end-use energy applications. To ensure this diversity, the case study facilities will be chosen from a pool of at least 200 candidates known to be successful and to meet all other applicable criteria. Candidate fa-

cilities will be identified from Meridian's own extensive files and from personal discussion with state energy program personnel, systems vendors, and other knowledgeable individuals. The case studies produced under this project are designed for use by technical/managerial decision makers in the commercial and industrial sectors. The most important use of these case studies is seen as being informative and education to those decision makers who are either unaware or unconvinced of the technical and economic soundness of biomass energy systems.

24318 (DOE/CH/10093—6, pp 318-319) **SERBEP guidebook on environmental issues for biomass energy projects.** DeZeeuw, R. (Nero and Associates, Inc., Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The preparation of an environmental guidebook will increase the likelihood of biomass energy projects being implemented in the Southeastern US because it will set forth environmental issues and regulations in a single, easy-to-use document. Private sector developers will be better able to define and know the environmental requirements and benefits of potential biomass projects, and regulatory officials will have a reference document that can be used to streamline procedures and addresses environmental issues for biomass projects. The availability of such a reference document would also help to minimize adverse environmental consequences, by aiding preconstruction planning for both developers and regulatory agencies. The objective of this project is to develop a document, which summarizes in a clear and understandable manner: (a) positive and negative environmental consequences associated with biomass energy projects, (b) potential environmental regulations, (c) applicable State and Federal environmental regulations and enforcement agencies for each of the 13 SERBEP states, and (d) potential environmental enforcement agencies. Existing literature resources on biomass will be reviewed and evaluated.

24319 (DOE/CH/10093—6, pp 326-327) **Biomass, nutrient, and energy yields of southern hardwood forests.** Frederick, D.J. (North Carolina State Univ., Raleigh). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Objectives are to: (1) determine amount and distribution of tree biomass, nutrient, and energy content in even-aged, fully stocked natural hardwood stands in the midsouth; (2) develop equations for predicting above parameters for trees and stands; (3) develop weight/volume factors for the major hardwood species in the region; and (4) develop information on wood properties including moisture content and specific gravity for the major hardwood species in the midsouth region. One-tenth acre plots have been randomly established in mixed, fully stocked, even-aged hardwood stands in the midsouth region. Two replications of three age classes (20, 40, and 60 years) on two site types (upland and bottom-land) have been located and sampled. Most sampled stands have been located on industrial forest land or national forests. All trees $\geqq$ 5.0 in. dbh were felled and measured and above-stump green weights recorded for total tree and components (stem, crown, foliage, wood, and bark). All trees 1.0-4.9 in. dbh on a 1/50 acre subplot located at the center of the 1/10 acre plot were also cut, weighed, and measured. Understory vegetations and soils were sampled. Data are being compiled.

24320 (DOE/CH/10093—6, pp 342-343) **Above ground biomass and volume yield of planted loblolly pine (Pinus taeda L.).** Baldwin, V.C. Jr. (Dept. of Agriculture, Pineville, LA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Loblolly pine (Pinus taeda L.) is the most important commercial tree species in the southern US, yet comprehensive information on its total biomass production in the west gulf region has not yet been obtained. Sample trees will be selected from permanent and temporary growth and yield study plots scattered throughout central Louisiana representing a wide array of sites, ages, stand densities, and density control treatments. Detailed information will be obtained from the stands and the felled trees. Mathematical models will be fitted with green- and dry-weight, volume, and taper data, and the resulting prediction equations will be added into a whole stand-diameter distribution yield prediction system for estimation of biomass and volume yields on a unit area basis. The data for the system of equations came from 859 measurements of thinned and unthinned long-term research study plots on cutover sites located in east Texas, Louisiana, southern Arkansas, and southern Mississippi, and from detailed measurements of 130 felled trees, mostly taken from within the Louisiana study plots. A computer program, COMPUTE-PLOB (Comprehensive outlook for managed pines using simulated treatment experiments-planted loblolly pine), that produces the stand and stock tables, is available from the principal investigator in a limited number of machine readable formats.

24321 (DOE/CH/10093—6, pp 344-345) **Development of a biomass harvesting system based on a roll-splitting process.** Sirois, D.L. (Dept. of Agriculture, New Orleans, LA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

An alternative to chipping at the harvesting site could be the processing of small diameter stems, 2 to 3 in. dbh, by roll crushing/splitting. With this process, a harvester could be built to cut and process the stems, depositing them on the ground in windrows for drying. The dried, split material could then be picked up by a separate machine and baled or modulized for low-cost transport for final processing and use at a permanent boiler facility. The potential advantages of this system are lower energy requirements for mobile operations, separation of harvesting/processing from the moduling/transporting operation, lower cost of transporting, and higher heating value of the dried energy wood. The objectives of this project are to: (1) conduct a literature review of past and ongoing research for biomass harvesting systems for small diameter - up to 5 in. - woody biomass; (2) develop engineering, production, and cost criteria for determining systems feasibility and design; and (3) assist TVA with testing of FERIC roll splitter and design and fabricate improvements to the roll splitter to meet established criteria for the Southeastern US and (4) test modified prototype of roll splitter. Progress to date is described.

24322 (DOE/CH/10093—6, pp 346-348) **Promote and access industrial wood energy use in Virginia.** Grimm, P. (Virginia Dept. of Mines, Minerals, and Energy, Richmond). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Virginia has large amounts of renewable wood resources available for use. Virginia's 16 million acres of forest alone (64% of all Virginia land) are a vast storehouse of renewable energy. Each year's production of sawdust, logging residue, and growth in low-quality unmerchantable trees contains energy equal to 42% of the state's industrial and commercial gas and oil consumption. Except for sawdust, most of this material is unused. Increasing industry utilization of this available resource will strengthen the state's economy, help improve the state's job situation, and give Virginia industries independence and flexibility in fuel types and cost for their facilities. The Virginia Department of Mines, Minerals, and Energy will conduct several information transfer activities to promote industrial use of wood resources. An industrial wood energy conference will be held, and a directory of wood-fired installations in the state will be published. A manual on industrial wood energy also will be published, featuring information on wood availability, methods of combustion, wood fuel storage and handling equipment, and environmental regulations. A survey of residential fuel wood use will be conducted to determine the quantity of firewood used and its possible impact on the forest resource. Progress to date is described.

24323 (DOE/CH/10093—6, pp 360-361) **R and D planning analysis.** Gaines, L.; Shen, S.Y.; Wallace, C. (Argonne National Lab., IL). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW. Contract W-31-109-ENG-38.

In Biofuels and municipal waste technology research program summary: FY 1986.

The work conducted under R & D planning analysis is designed to provide information, research planning methods, and technical assessments that support the planning of an efficient and successful Biofuels and Municipal Waste Technology Program. The project consists of three subtasks: (a) Research Goals: (1) define integrated fuel cycles, (2) estimate current biofuel cost, (3) compare with competing fuel price projections, (4) establish biofuel cost goal, (5) apportion goal by setting equal challenge to production and conversion components of goal, (6) establish production and conversion cost goals, and (7) establish production and conversion performance goals; (b) Uniform Cost-Estimation Method: update the method to reflect current financial assumptions (as described in the new EPRI Technical Assessment Guide) and new tax regulations. Make available in report form and in a user-friendly personal computer version; (c) Technology Development Strategy: update previous strategic planning document by revising technology development pathways, key research areas, and time schedules for technical options of greatest importance.

24324 (DOE/ER/12029—T2) **Genetics of bacteria that utilize one carbon compounds: Final report, March 1, 1982-February 29, 1988.** Hanson, R.S. (Minnesota Univ., Navarre (USA). Gray Freshwater Biological Inst.). Feb 1988. Contract AC02-82ER12029. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006376/JAW.

Broad host range plasmid vectors useful for cloning genes from bacteria that grow on methane and methanol were constructed. We have cloned and mapped nineteen genes required for the growth of Methylobacterium organophilum strain XX on methanol. Nineteen genes were found in seven linkage groups on the M. organophilum genome and were separated by 40 kb or more. Eleven genes were required for the synthesis of methanol dehydrogenase (MDH) and were located in three unlinked gene clusters. The MDH structural gene was localized on a 2.5 kb DNA fragment. The gene was sequenced and contains a 175 bp untranslated leader sequence, a signal sequence and the structural gene. MDH messenger RNA (mRNA) has a half life of approximately 20 min. and is present at approximately 2% of the cellular mRNA. The structural gene for the γ subunit of methane monoxygenases has been cloned from Methylosporovibrio. Methane monooxygenase subunits have been purified by Prof. J. Lipscomb's laboratory and are being sequenced to construct DNA probes to identify cloned subunit genes. New facultative methylotrophic bacteria were isolated and characterized. Several amino acid auxotrophs have been isolated. 11 refs.

24325 (DOE/ER/13179—1) **Role of turgor pressure and solute transport in plant cell growth: Progress report.** Cosgrove, D.J. (Pennsylvania State Univ., University Park (USA). Dept. of Biology). 15 Oct 1987. Contract FG02-84ER13179. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006095/JAW.

We have worked on three major areas, as outlined in the major grant proposal of last year. These are measurement of wall relaxation by pressurization, coupling between cell expansion and solute uptake, and experiments with severed aphids. We have advanced very rapidly in the first area, reasonably well in the second area, and have been delayed in the third area. A new method, termed the pressure-block technique, was developed this past year to measure the yielding characteristics of growing plant cell walls. The way it works is as follows. Our first approach in studying the relationship between solute uptake and growth was to reduce the solute supply to elongating pea stems of etiolated seedlings by excising the cotyledons. Solute import was effectively stopped over the 5 h period after excision; no net change in dry weight of a 0.5 cm segment occurred 5 h after cotyledon removal, compared to an increase of 0.3 mg in intact seedlings. We constructed a radio frequency microcautery device, and succeeded in excising the stylets from pea aphids feeding on pea epicotyls, but exudation quickly ceased. It may prove more practical to probe into the phloem directly with the pressure probe, without using the aphid stylet.

24326 (DOE/ER/13533—2) **[Photoinhibition of PSII traps, photoactivation and reconstruction of the PSII trap/water oxidizing complex: Progress report, February 1987-February 1988].** (Kentucky Univ., Lexington (USA). Research Foundation). 1988. Contract FG05-86ER13533. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006068/JAW.

This progress report describes activities for the period from February 1987 to February 1988 in five related subject areas. The areas of study reported on are the inhibition of photosynthesis during development of manganese toxicity in tobacco, evidence for effects on the in vivo activity of ribulose-bisphosphate carboxylase/oxygenase during development of manganese toxicity, calcium stabilizes the light-induced Mn^{+3} in photosystem II membranes incompetent in water oxidation, the high affinity Ca^{+2} site required in photosynthetic O_2 evolution is created by the polynuclear Mn catalyst, and the isolation of PSII core complexes having high rates of oxygen evolution. (DT)

24327 (DOE/ER/13586—T1) **Metabolism of aromatic compounds by actinomycetes: Final report, August 1, 1986-April 1, 1987.** Crawford, D.L. (Idaho Univ., Moscow (USA). Dept. of Bacteriology and Biochemistry). 1987. Contract FG07-86ER13586. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88005858/JAW.

The research objectives are: isolate and characterize stable S. viridosporus mutants which are either negative for or enhanced in the ability to produce cellulase, xylanase, and the B-ether cleaving ligninase complex; to isolate and characterize stable mutants which are derepressed for lignin degradation; and clone the gene coding for lignin depolymerization into a nonligninolytic streptomycete, S. lividans. We have obtained stable mutants and an extracellular peroxidase that appears to be a ligninase. A more efficient plasmid vector cloning system for cloning S. viridosporus DNA into S. lividans has been developed. We have successfully used the plasmid to clone a cellulase gene and a peroxidase gene from S. viridosporus into E. coli, and we are now moving the genes into S. lividans to study their expression in this nonligninolytic streptomycete. We have isolated two of the genes coding for enzymes essential for lignocellulose degradation.

24328 (DOE/ER/60381—3) **Interaction of H_2O and nitrogen stresses on trees: Final report, 1 October 1986-30 September 1987.** Weber, J.A. (Michigan Univ., Ann Arbor (USA)). 18 Feb 1988. Contract FG02-85ER60381. 19p. NTIS, PC A03. Order Number DE88006682/JAW.

The effect of water stress on photosynthesis of Quercus rubra (red oak), growth response of Populus grandidentata (bigtooth aspen) to nitrogen fertilization, and modelling of whole-leaf gas exchange was studied. Conditions for storage of aspen seeds were found. We have established the useful range for nitrogen fertilization for P. grandidentata with preliminary data on Q. rubra. Data was collected on photosynthetic response of leaves from plants grown at different nitrogen levels. These data confirm the growth responses observed, in that the rate of application that produced the greatest growth also produced leaves with the greatest photosynthetic capacity. Experiments on the effects of air to leaf vapor pressure difference showed that VPD can affect photosynthesis in these plants. Theoretical studies continued in the form of a computer program that incorporates energy budget equations, solar geometry, and a mechanistic model of photosynthesis into program that allows prediction of leaf temperature, transpiration, and photosynthesis for leaves in any orientation at any time of the year at any point on the globe. 4 figs., 1 tab.

24329 (DOE/OR/21390—16) **Great Lakes Regional Biomass Energy Program: Final report, September 1, 1985-August 31, 1986.** Bancroft, D. (Council of Great Lakes Governors, Inc., Madison, WI (USA)). Dec 1987. Contract FG05-83OR21390. 112p. NTIS, PC A06. Order Number DE88006529/JAW.

This is the annual report of the third year of operation of the Great Lakes Regional Biomass Energy Program. The program was initiated in 1983 with a grant to the Council of Great Lakes Governors from the Biofuels and Municipal Waste Technology Division

of the US Department of Energy. Stressing near-term biomass feedstock production techniques and conversion processes, the objective of the program is to increase the use of biomass energy by the public and private sectors in the seven state Great Lakes region. States that are in the Great Lakes region include: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio and Wisconsin.

24330 **(EMR/ER—860408) Liquefaction of lignocellulosic materials by means of organic solvents.** Vanasse, C.; Chornet, E.; Overend, R.P. (Ministere de l'Energie, des Mines et des Resources, Ottawa, Ontario (Canada). Direction des Energies Renouvelables). 8 Apr 1986. 300p. (In French). (MICROLOG—87-05221). Bioenergy Development Program. Renewable Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report describes liquefying biomass to produce an oil to be recognized as a prototype oil or proto-oil. The direct liquefaction approach, which involves contacting the biomass with solvents at high temperatures (320-350/sup 0/C) was followed. Sections of this study cover aspects of liquefaction as related to continous process operation. The development on pumpability of concentrated wood suspensions or slurry was done with a mineral oil solvent. From weakly concentrated wood slurries (6-8%), highly concentrated wood slurries (20-30%) were prepared by progressive addition of fresh wood followed by the passage of the slurry through a special homogenizing valve forcing structural disaggregation via mechanical work. This structural disaggregation associated with partial solubilization of the wood allows increased pumpability. More fundamental aspects of the process were covered with creosote oil and ethylene glycol. Complete mass balances on the process were obtained with the ethylene glycol. The chemical evolution of wood was followed by thermal analysis and by viscosimetry leading to measurements of degree of polymerization of cellulose. The structural disaggregation was observed by optical and scanning electron microscopy. The liquid phase was characterised by simple distillation, elemental analysis, viscosity, density and by sequential elution solvent chromatography. In the fractional liquefaction approach, the residual cellulose recovered was tested by enzymatic hydrolysis for its capability to form sugars which, after fermentation, can give ethanol. The recovered hemicelluloses were analyzed by size exclusion chromatography while the recovered lignin was characterized by thermal analysis as well as elemental analysis.

24331 **(EUR—9842) Preparation of copper sulphide by electrolysis and simultaneous deposition of copper.** Vedel, J.; Cowache, P.; Lincot, D. (Commission of the European Communities, Luxembourg). 1985. 59p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752389/JAW.

The aim of the research was to demonstrate the possibility for forming copper sulphide of photopiles CdS-Cu/sub 2/S by cathodic reduction. The possibility of producing a Cu/sub 2/S of a good stoichiometric ratio (1.99) on surfaces of about 10 cm/sup 2/ thanks to the use of an electrolyte containing a convenient masking agent (TRIEN). The extension to larger surfaces poses no problem. The reaction time is quite high (10 to 20 mn). The reaction is only produced on passing a current, which allows an easy control of production. According to experimental conditions, one can deposit a greater or smaller quality of copper at the same time as the Cu/sub 2/S. A special technique for the formation of the collecting grid by cathodic deposit of gold has been developed. It consists principally of depositing the grid before the photovoltaic Cu/sub 2/S. The best photopiles obtained had the following characteristics: Area: 1.5 cm/sup 2/, V/sub co/ = 0.51 V, I/sub cc/ = 22 mAcm/sup -2/, eta = 7%. Analysis of the junction shows that there is no significant migration of copper during the deposit. The thermic treatment causes a less disturbed compensated zone to appear by the texture of the CdS than the deposits obtained by the exchange of ions. This would be favourable to the stability of the piles. Some problems remain, in particular the deposit of copper on the grid at the time of the formation of the Cu/sub 2/S. Possibilities for improvements are proposed.

24332 **(LBL—24018) Chemical Biodynamics Division: Annual report, October 1, 1986-September 30, 1987.** (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004886/JAW.

Investigators are studying the various components that make up the photosynthetic reaction center complexes in many different organisms. This work not only involves understanding the kinetics of energy transfer and storage in plants, but also includes studies to work out how photosynthetic cells regulate the expression of genes encoding the photosynthetic apparatus. The second biological theme is a series of investigations into the relationship between structure and function in nucleic acids. Our basic mission in this program is to couple our chemical and biophysical expertise to understand how not only the primary structure of nucleic acids, but also higher levels of structure including interactions with proteins and other nucleic acids regulate the functional activity of genes. In the chemical sciences investigators are increasing our understanding of the fundamental chemistry of electronically excited molecules, a critical dimension of every photosynthetic energy storage process. We are developing approaches not only toward the utilization of sophisticated chemistry to store photon energy, but also to develop systems that can emulate the photosynthetic apparatus in the trapping and transfer of photosynthetic energy. Individual projects are processed separately for the data base.

24333 **(NP—8770092) Investigations of anaerobic degradation of waste water from chemical processes in industrial sewage treatment plants.** Schelchshorn, J.; Blank, D. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1987. 135p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770092/JAW.

Two concepts for biological treatment of industrial waste water were investigated. Concept 1 invisaged a joint anaerobic treatment of municipal sewage and industrial waste water. Concept 2, in which the industrial waste water was treated separately in an anaerobic activation process or by an anaerobic filter, intended to minimize the sludge volume to enable sludge disposal by combustion if necessary. Experiments were made on laboratory scale, pilot scale, and in the municipal sewage treatment plant of Abwasserverband Raumschaft Lahr (AV). The results showed: 1. Separate anaerobic treatment of industrial waste water according to concept 2 is not feasible. 2. Joint anaerobic treatment of industrial waste water and municipal sewage sludge according to concept 1 had excellent results with CSB and AOX degradation rates over 80%. The total biogas yield of the AV sewage treatment plant was higher by 65 to 80% with concept 1 than with concept 2.

24334 (PNL—6100-Pt.2, pp 47) **Detection of genetically engineered microorganisms.** Fredrickson, J.K. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Recombinant DNA technology holds many promises, but there is also concern over the release of any genetically engineered microorganisms (GEMs) into the environment, whether deliberate or accidental. Risk assessment requires careful monitoring of GEMs once released. Research at PNL has established capabilities for detecting GEMs and determining their fate and potential hazards to the ecosystem. To achieve this, model GEMs were constructed by inserting transposable genes into soil bacteria for use as identifiers. A rapid most-probable-number procedure, used in conjunction with DNA hybridization, was able to detect the model GEMs in several soil types at a sensitivity equal to or greater than presently available methods.

24335 **(SAND—88-0146) 1988 Photovoltaics annual systems symposium: Agenda and abstracts, February 16, 17, and 18, 1988, Phoenix, Arizona.** Chapman, R.N. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1988. Contract AC04-76DP00789. 69p. (CONF-880252—Absts.). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006224/JAW.

From Photovoltaics annual systems symposium; Phoenix, AZ, USA (16 Feb 1988).

Phoenix, Arizona, is the location for the 1988 Photovoltaics Annual Systems Symposium (PASS 88) scheduled to run from February 16-18 in conjunction with the annual meetings of the Solar Energy Industries Association (SEIA) and the Interstate Solar Coordination Council. PASS 88 is sponsored by Sandia National Laboratories, and the session on applications of photovoltaics for the military is co-sponsored by the Department of Defense, Sandia/DOE, and SEIA. This report contains highlights from PASS 87, the agenda for the PASS 88 symposium, and extended abstracts for the presentations at PASS 88. The sessions are on Military Applications, Stand-Alone Systems, Grid-Connected Systems, and State and Federal Programs.

24336 **(TU/LMCL—810327) Development of transition metal semiconductors for photoelectrolysis of water. Final report.** Dignam, M.J.; Weber, M.F. (Toronto Univ., Ontario (Canada). Lesh Miller Chemical Labs.). 27 Mar 1981. 35p. (MICROLOG—82-1556). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report discusses the development of transition metal oxide semiconductors for photoelectrolysis of water. More specifically, it involves preparation of TiO/sub 2/ films by sputtering and evaluating their physicochemical characteristics primarily as they relate to the behaviour of the films as photoanodes. Impedance, photoelectrochemical, and photoconduction properties of TiO/sub 2/ films sputtered in pure O/sub 2/ onto heated substrates have been determined as a function of O/sub 2/ pressure during sputtering, film thickness, Pt overcoating, and cathodic treatment. The capacitance data before cathodic treatment are of the form expected. The capacitance is essentially independent of potential, while for potentials increasingly cathodic of this value, the capacitance increases very rapidly. Cathodic treatment alters the impedance characteristics of the films but leads to either no detectible change in their photoelectrochemical properties or to an increase in the photocurrent. In all cases there is no change in the photo-onset potential for 0/sub 2/ evolution. There is no evidence that cathodic treatment leads to an increase in carrier concentration. Pt overcoatings lead to anodic shifts of as much as 500 mv. Cathodic treatment reduces this but does not change the impedence characteristics of the films. Freshly deposited films display photoconductivity. Thinner TiO/sub 2/ films show a somewhat more rapid rise in photocurrent.

24337 **Temperature-dependent valence isomerization in a manganese tetraphenylporphyrin.** Maliyackel, A.C.; Otvos, J.W.; Calvin, M.; Spreer, L.O. (Lawrence Berkeley Lab., CA). *Inorganic Chemistry;* **26**: No. 24, 4133-4135(2 Dec 1987). Contract AC03-76SF00098.

The preparation and properties of a manganese tetraphenylporphyrin compound, $MnTTP(CF_3SO_3)_2$, are described. This compound is believed to undergo temperature-dependent valence isomerization from a manganese(III) pi cation radical at higher temperature to a manganese (IV) porphyrin at reduced temperatures. The compound is produced by a one-electron oxidation from the starting material MnTPP(Cl) containing a trivalent Mn. The data reported support the hypothesized temperature-dependent oxidation-state change. 12 references, 3 figures, 1 table.

1406 Photovoltaic Power Systems

24338 **(SAND—87-2585) Today's photovoltaic systems: An evaluation of their performance.** Menicucci, D.F.; Poore, A.V. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006926/JAW.

Photovoltaic systems offer the potential to provide a viable and important source of energy both for today and tomorrow. A key factor in verifying this potential is assessing the satisfactory field performance of the systems, together with their maintenance cost and requirements. Recognizing this need, the National Photovoltaic Program instituted a systems evaluation group nearly a decade ago. Since then, numerous systems - large and small - have been evaluated, and industry has used the results to perfect the technology. The result of this government/industry partnership is a photovoltaic system technology of which we are proud. The systems evaluations, results of which are reported in this document, have verified the technical viability of the technology. Long-term operation and maintenance goals set by the national program have been met - certainly an enviable record.

24339 **(SAND—87-7016) Photovoltaics for military applications: A decision-makers guide.** (Meridian Corp., Alexandria, VA (USA)). Jan 1988. Contract AC04-76DP00789. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006927/JAW.

This report is designed to be a guide to the use of photovoltaic technology for military applications. Descriptions and illustrations of the technology are provided, together with discussions of specific, cost-effective applications. The report tells readers how to decide whether photovoltaic technology could be viable for their needs. The procurement process is reviewed in terms of how to prepare a justification and obtain approval for a proposed project that uses photovoltaics. Appendices are included to guide the user in estimating costs and payback periods. 21 figs.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 24345

24340 **(LA-UR—87-3950) Development of an integrated heat pipe-thermal storage system for a solar receiver.** Keddy, E.S.; Sena, J.T.; Merrigan, M.A.; Heidenreich, G.; Johnson, S. (Los Alamos National Lab., NM (USA); Sundstrand Corp., Rockford, IL (USA). Sundstrand Energy Systems; National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1987. Contract W-7405-ENG-36. 10p. (CONF-8706254—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003153/JAW.

From Thermophysics conference; San Antonio, TX, USA (27 Jun 1987).

The Organic Rankine Cycle (ORC) Solar Dynamic Power System (SDPS) is one of the candidates for Space Station prime power application. In the low earth orbit of the Space Station approximately 34 minutes of the 94-minute orbital period is spent in eclipse with no solar energy input to the power system. For this period the SDPS will use thermal energy storage (TES) material to provide a constant power output. Sundstrand Corporation is developing a ORC-SDPS candidate for the Space Station that uses toluene as the organic fluid and LiOH as the TES material. An integrated heat-pipe thermal storage receiver system is being developed as part of the ORC-SDPS solar receiver. This system incorporates potassium heat pipe elements to absorb and transfer the solar energy within the receiver cavity. The heat pipes contain the TES canisters within the potassium vapor space with the toluene heater tube used as the condenser region of the heat pipe. During the insolation period of the earth orbit, solar energy is delivered to the heat pipe in the ORC-SDPS receiver cavity. The heat pipe transforms the non-uniform solar flux incident in the heat pipe surface within the receiver cavity to an essentially uniform flux at the potassium vapor condensation interface in the heat pipe. During solar insolation, part of the thermal energy is delivered to the heater tube and the balance is stored in the TES units. During the eclipse period of the orbit, the balance stored in the TES units is transferred by the potassium vapor to the toluene heater tube. 3 refs., 8 figs.

24341 (SAND—86-1910) Performance of the Solar Total Energy Project at Shenandoah, Georgia. Stine, W.B.; Heckes, A.A. (California State Polytechnic Univ., Pomona (USA); Sandia National Labs., Albuquerque, NM (USA)). Feb 1988. Contract AC04-76DP00789. 190p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88006923/JAW.

This report contains an evaluation of the performance of the Solar Total Energy Project (STEP) at Shenandoah, GA. A set of experiments was conducted under varying isolation conditions using solar-only, fossil-only, and hybrid energy sources. The electrical and thermal loads on the cogeneration plant were varied, and different interface configurations with the local utility grid were evaluated. A description of the STEP facility, descriptions of the test objectives and setup, and analysis of the test data are presented. In addition, a computer simulation of the STEP plant system is discussed. 26 figs., 13 tabs.

24342 (SAND—87-1569C) Thermal modeling of solar central receiver cavities. Skocypec, R.D.; Romero, V. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-880457—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004940/JAW.

From American Society of Mechanical Engineers Solar Energy Division conference; Golden, CO, USA (10 Apr 1988).

Results are presented from a numerical model of the steady-state energy transfer in molten-salt-in-tube solar cavity receivers that includes convective energy transfer at a local (spatially resolved) level. Molten salt energy absorption and gray radiative transfer between all cavity surfaces are also included. This model is applied to the MSS/CTE cavity receiver. Results for this receiver indicate the global receiver thermal efficiency is invariant within a few percent to most parameters investigated, although front surface temperatures of the nonabsorbing walls vary considerably, and are particularly sensitive to the type of convective submodel used. Absorption efficiencies indicate the effects of the cavity enclosure environment. For all conditions investigated, tube inner wall temperatures remain under 855 K, ensuring that the salt remains chemically stable. Global (entire cavity) results for the receiver indicate thermal conditions in the receiver are temporally constant within an hour of solar noon, and solar panel temperatures are governed by the temperature of the flowing salt (the outlet temperature is maintained at 839 K by varying the salt mass flowrate). The dominant loss mechanism is radiative transfer, although convective loss predictions are of the same order of magnitude. The absorbing panel front surface temperatures and the panel thermal losses are somewhat invariant with incident flux. Losses from the nonabsorbing surfaces (comprising over 60% of the cavity surface area), however, do vary with incident flux levels. These results suggest that a correction for nonconstant losses in the Barron flux-on loss method is necessary. 10 refs., 9 figs., 1 tab.

1409 Solar Thermal Utilization

24343 (AENR—1/17-16) Passive solar. (Alberta Energy and Natural Resources, Edmonton (Canada)). 1987. 26p. (MICROLOG—87-06085). Alberta Dept. of Energy, Energy Conservation Branch, Petroleum Plaza Tower, 9915-108 St., Edmonton, Alta., Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A home with passsive solar features uses the sun's energy for space heating. This booklet explains how passive solar heating works and gives basic rules of thumb that are sensitive to Alberta's climate and latitudes. The booklet is divided into three parts. The first section defines solar heating, followed by basic rules for passive solar design. The final section applies these guidlines to two examples. This booklet assumes that if you are considering passive solar features, you are already planning to build or renovate to energy efficient standards.

24344 (NP—8770106) Solar village No. 3 - Lycovryssi, Athens. Report phase 2. Vol. 1. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Jul 1982. 121p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770106/JAW.

In the course of a joint project of Germany and Greece, a solar village was constructed on the outskirts of Athens. The village has one-storey and multistorey buildings, all of which have solar water heating and air conditioning systems. The site, the housing structure (435 apartments), the insulated walls, the Trombe walls, and the solar-heated, water-filled collector tubes on the inclined roofs are described. Constructional features of the different house types and their passive solar systems are presented. Electromechanical installation are described as well as the calculation and construction criteria of the passive solar systems. (HWJ).

24345 (NP—8770107) Solar village No. 3 - Lycovryssi, Athens. Description of the active space heating and domestic hot water solar systems of solar village 3 in Athens, Greece. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). 1982. 108p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770107/JAW.

A solar village with 435 apartments was constructed on the outskirts of Athens in a joint Greek-German projekt. The report discusses the settlement structure, house types, and economic and energetic aspects of the solar systems. Heating systems are gone into (vacuum tube collectors, thermosyphon collectors, heat pumps, storage tanks, thermal insulation, pipelines). The direction of the buildings, the heat carriers, climate factors, night temperatures, sunshine hours and insulation levels are mentioned. Computer programs (TEDDY, SOLARA) are presented, and the measuring systems.

24346 (NP—8770114) 51 solar heated swimming pools in the European Community. Final report. Bellanger, M.; Kaut, W.; Luboschik, U. (Commission of the European Communities, Brussels (Belgium)). Mar 1987. 224p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770114/JAW.

The aim of this demonstration programme is to gain experience with solar systems to heat swimming pools with a watersurface area larger than 200 m/sup 2/. Most of the swimming pools are managed by public authorities, but they were selected to give a good coverage of different circumstances, such as size of the solar plant, reliability of different collectors and materials involved, experience with heat recovery systems and pool covers and finally the cost effectivness of the systems. The purpose of this booklet is to provide a brief description of the installations, with illustrations, and to give the results of the monitoring campaign. Different kinds of pools are illustrated: open air, indoor and partially open air pools. Apart from the solar systems themselves, various energy saving devices have also often been installed, such as pool covers (mainly for open air pools), for heat recovery from filter backflushing water, for heat recovery from the pool hall's ventilation system, heat pumps etc. (orig./HWJ).

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 24345

24347 (PNL-SA—15167) Performance and cost implications of the FMDF [Fixed Mirror Distributed Focus] collector. Dirks, J.A.; Williams, T.A.; Brown, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1987. Contract AC06-76RL01830. 24p. (CONF-880420—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000100/JAW.

From Testing and measurement in solar energy systems; Denver, CO, USA (10 Apr 1988).

The Fixed Mirror Distributed Focus (FMDF) hemispherical bowl is a solar thermal power technology which has been studied for several years as a potentially attractive means of producing electricity. This paper discusses projections of the collector (con-

centrator and receiver) performance and cost that could be achieved by the FMDF technology, based on the assumption of continued technology development and high volume production. 4 refs., 3 figs., 6 tabs.

1420 Heat Storage

REFER ALSO TO CITATION(S) 24511

24348 **(PIRSEM—3036) Latent heat storage.** Peube, J.L. (Centre National de le Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matieres Premieres). 1983. 480p. (In French). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88752386/JAW.

In this study, a latent heat thermal storage prototype system have been designed and developed. The operating temperatures are relatively low (300 to 500 deg C). Encapsulation (or packaging) is the main characteristic of the system: a great number of individual capsules containing the heat storage medium are immersed in the heat transfer medium. Experimental results are compared to simulation calculations and optimization procedures are performed.

15 GEOTHERMAL ENERGY

REFER ALSO TO CITATION(S) 24549

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 24076

24349 **(LA—11224-MS) FEHM: finite element heat and mass transfer code.** Zyvoloski, G.; Dash, Z.; Kelkar, S. (Los Alamos National Lab., NM (USA)). Mar 1988. Contract W-7405-ENG-36. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88005902/JAW.

The finite element heat and mass (FEHM) transfer code is a computer code developed to simulate geothermal and hot dry rock reservoirs. It is also applicable to natural-state studies of geothermal systems and ground-water flow. It solves the equations of heat and mass transfer for multiphase flow in porous and permeable media using the finite element method. The code also has provisions for a noncoupled tracer; that is, the tracer solutions do not affect the heat and mass transfer solutions. It can simulate two-dimensional, two-dimensional radial, or three-dimensional geometries. A summary of the equations in the model, the numerical solution procedure, and model verification and validation are provided in this report. A user's guide and sample problems are included in the appendices. 17 refs., 10 figs., 4 tabs.

24350 **(UAG-R—310) Stratigraphy, petrology, and geochemistry of the Spurr Volcanic Complex, eastern Aleutian Arc, Alaska.** Nye, C.J. (Alaska Univ., Fairbanks (USA). Geophysical Inst.). Dec 1987. Contract AC07-76ID01570. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88006849/JAW.

The Spurr Volcanic Complex (SVC) is a calcalkaline, medium-K, sequence of andesites erupted over the last quarter of a million years by the easternmost currently active volcanic center in the Aleutian Arc. The ancestral Mt. Spurr was built mostly of andesites of uniform composition (58 to 60% SiO_2), although andesite production was episodically interrupted by the introduction of new batches of more mafic magma. Near the end of the Pleistocene the ancestral Mt. Spurr underwent Bezyianny-type avalanche caldera formation, resulting in the production of a volcanic debris avalanche with overlying ashflows. Immediately afterward, a large dome (the present Mt. Spurr) was emplaced in the caldera. Both the ashflows and dome are made of acid andesite more silicic than any analyzed lavas from the ancestral Mt. Spurr (60 to 63% SiO_2), yet contain olivine and amphibole xenocrysts derived from more mafic magma. The mafic magma (53 to 57% SiO_2) erupted during and after dome emplacement, forming proto-Crater Peak and Crater Peak. Hybrid pyroclastic flows and lavas were also produced. Proto-Crater Peak underwent glacial dissection prior to the formation of Crater Peak in approximately the same location. Appendices II through VIII contain a summary of mineral compositions; Appendix I contains geochemical data. Appendix IX by R.J. Motyka and C.J. Nye describes the chemistry of geothermal fluids. 78 refs., 16 figs., 3 tabs.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 24350

24351 **(LBL—23719) Effects of steam-liquid counterflow on pressure transient data from two-phase geothermal reservoirs.** Bodvarsson, G.S.; Cox, B.L.; Ripperda, M. (Lawrence Berkeley Lab., CA (USA)). Jun 1987. Contract AC03-76SF00098. 9p. (CONF-870913—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006321/JAW.

From Annual technical conference and exhibition of the Society of Petroleum Engineers; Dallas, TX, USA (27 Sep 1987).

Numerical studies are performed to investigate the effects localized feedzones on the pressure transients in two-phase reservoirs. It is shown that gravity effects can significantly affect the pressure transients, because of the large difference in the density of liquid water and vapor. Production from such systems enhances steam/liquid water counterflow and expands the vapor-dominated zone at the top of the reservoir. Subcooled liquid regions develop in the center of the reservoir due to gravity drainage of cooler liquid water. The vapor zone will act as a constant pressure boundary and help stabilize the decline in the system. It is shown that the pressure transients at observation wells depend greatly on the location (depth) of the major feedzone; if this is not accounted for, large errors in deduced reservoir properties will result. At shallow observation points pressures may actually increase as a result of enhanced steam upflow due to production at a deep feedzone. 12 refs., 17 figs.

24352 **(LBL—24661) Analysis of P- and S-wave VSP [vertical seismic profile] data from the Salton Sea Geothermal Field.** Daley, T.M. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 262p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88006348/JAW.

To understand any geophysical data, geologic information is necessary. This thesis will begin with a summary of the geology of the Salton Trough region and the Salton Sea Geothermal Field (SSGF). The information available from the SSSDP will also be summarized. After the geologic summary, the design of the VSP will be discussed, including acquisition equipment and procedures. The data processing procedures and software used will be discussed as a separate section. Processing procedures will also be described at various times in the thesis where more specialized procedures are used. Data analysis makes up the bulk of the thesis and it is divided into a number of sections detailing the basic VSP interpretation, the anisotropy analysis and the fracture detection and orientation analysis. A combined interpretation of the results, with probable geologic causes for observed events, is presented as a separate section from the data analysis. Finally, a summary of results for each of the goals stated above will be given. The reader should note that a large volume of data were collected and various display methods were used (from the standard wiggle-trace to three-component hodographs). Much of these data are left in the appendices with important or representative figures given in the body of the thesis. Also given in the appendices are listings of FORTRAN programs developed in conjunction with the thesis work. 46 refs., 63 figs., 12 tabs.

1505 Economic And Financial Aspects

24353 (SAND—87-7018) IM-GEO: Impact of R and D on cost of geothermal power: Documentation of Model Version 2.09. Petty, S.; Entingh, D.; Livesay, B.J. (Mesquite Group, Fullerton, CA (USA); Meridian Corp., Falls Church, VA (USA); Livesay Consultants, San Diego, CA (USA)). Feb 1988. Contract AC04-76DP00789. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88006602/JAW.

IM-GEO is an analysis used to estimate the impact of technology improvements on the relative cost of hydrothermal power. The analysis is available in a tutorial program for use on personal computers. It is designed for use by R and D program managers to evaluate R and D options. Only the potential impact of technologies is considered with all economic factors being held constant. This analysis has one unique feature. The economic impact of reducing risk by improving reservoir characterization is included using a strategy currently employed by financial institutions. This report describes the basis of the calculations, documents the code, and describes the operational procedures. Application of the code to study potential cost reductions due to R and D success will be done by R and D managers to evaluate and direct their own programs.

1506 Environmental Aspects And Waste Disposal

24354 (BNL—40640) Stabilization of geothermal residues by encapsulation in polymer concrete and portland cement mortar composites. Webster, R.P.; Kukacka, L.E. (Brookhaven National Lab., Upton, NY (USA)). Nov 1987. Contract AC02-76CH00016. 16p. (CONF-880350—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006359/JAW.

From Technical symposium on polymer concrete; Orlando, FL, USA (20 Mar 1988).

Presented are the results from the preliminary phase of a laboratory test program conducted to identify and evaluate materials for converting hazardous geothermal residues to a non-hazardous and potentially usable form. Laboratory test results indicate that geothermal residues can be effectively incorporated, as a fine aggregate, into polymer concrete (PC) and portland cement mortar (PCM) composites. PC composites made using an emulsifiable polyester resin and a methyl methacrylate (MMA)-based monomer system exhibited compressive strengths varying between 3700 and 16,500 psi (25.5 and 113.8 MPa), depending upon the type of binder used and the moisture content of the residue. Waste extraction tests (WET) performed on ground samples of the composites indicate elemental levels of leachable heavy metals are below specified soluble threshold limit concentrations (STLC), thereby allowing the composites to be classified as non-hazardous. PCM composites exhibited compressive strengths varying between 2875 and 5530 psi (19.8 and 38.1 MPa), depending upon the type, amount and moisture content of the residue. WET analysis indicates that all but one of the PCM composites evaluated can be classified as non-hazardous. 8 tabs.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 24353

17 WIND ENERGY

1706 Wind Energy Engineering

24355 (DOE/CE—0189) Energy from the wind. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Jul 1987. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006897/JAW.

This document provides a brief description of the use of wind power. Windmills from the 18th century are described. Modern wind turbines and wind turbine arrays are discussed. Present and future applications of wind power in the US are explained. (JDH)

24356 (SERI/TR—217-3125) FLAP [Force and Loads Analysis Program] code development and validation. Wright, A.D.; Buhl, M.L.; Thresher, R.W. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1988. Contract AC02-83CH10093. 330p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE88001131/JAW.

The Force and Loads Analysis Program (FLAP) has been refined to include the teetering degree of freedom (without delta-3). This report describes these refinements, as well as comparisons of predicted blade-bending moments to tet measurements. Wind-tunnel data for a 1/20-scale model of the Boeing MOD-2 machine were used to compare FLAP predictions for the cyclic flap-bending moments at the 33% spanwise station for three different wind speeds. The comparisons were made for both rigid- and teetering-hub cases. The code was written in Fortran 77 to be especially useful on the IBM PC family of computers. A special effort was made to make the program "user friendly" and readable. This report can be used as a user's guide; it includes a program description, a method of preparing input files, and information on the correct method of executing the code. A method of correctly preparing blade input data from a structural-dynamics viewpoint is also described. The code and this report are now available for public use. 10 refs., 28 figs., 22 tabs.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 25673

24357 (EP/GE—3/30) Group of experts on electric power stations report. (United Nations, Geneva (Switzerland). Economic Commission for Europe). 25 Nov 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900392/JAW.

This document contains the minutes from a meeting of the UN's committee on electric power. Participating nations contributed papers discussing areas of research in power station operation. (JDH)

24358 (EP/R—131) The electric power situation in the ECE Region in 1986. (United Nations, Geneva (Switzerland). Economic Commission for Europe). 1 Dec 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88900390/JAW.

This report lists several facts concerning electricity generation and use in western Europe during 1986. Generator sources are compared by region. End users are listed by economic sector and country. (JDH)

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 24453, 24634

24359 (BMFT-FB—02-CT-024-b) Project definition and experimental investigation for a multi-purpose plant for the generation of electricity and production of drinking water and raw materials from seawater. Final report. Mader, A.; Nathrath, N.; Zenz, F.R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 215p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770093/JAW.

The hybrid-plant for seawater distillation use in a multipurpose plant has been operated in an experimental investigation in conjunction with a combined MSF/VTE-evaporator (Multistage-Flash Vertical Tube Evaporator) and has been improved to such an extent that the construction of a prototype plant within a demonstration plant can be realized. A new hybrid-process for thermal seawater desalination has been developed. The MSF/VTE-procedure is described by a simulation model. The design of seawater evaporators as well as the demands on the materials have been established. The MSF/VTE-pilot plant has been operated under

severe conditions and can be used as a basis for a complete 5 MIGD-MSF/VTE-plant. The project is reported in six volumes which consist of this summary and five appendices.

24360 **(EPRI-EL—5666) Knowledge-based systems for electric utility operation using the PROLOG language: Final report.** Tweed, E.D. (Union Electric Co., St. Louis, MO (USA)). Feb 1988. 107p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920219/JAW.

The objective of this research project was to investigate the desirability of developing knowledge based systems in the PROLOG, PROgramming in LOGic, language for electric utility system operation applications. Two major steps were completed to achieve this objective. The first step was to develop a protection system simulator and diagnostican in the PROLOG language. Finally, a demonstration volt/VAR dispatch knowledge based system was developed in the PROLOG language. It was shown that a realistic model of an electrical system and its interconnections could be developed by interacting between the PROLOG knowledge based system and a FORTRAN power flow program. Results of the simulation indicated that the decisions reached in the volt/VAR dispatch program were consistent with the operation of a control center. For control applications in which the rules utilized are prioritized, the structure of the PROLOG language provides an inference mechanism that has an advantage over the basic inference process of OPS-5. The conclusion of this study is that PROLOG is a highly desirable language for the development of knowledge based systems for electric utility applications. 2 figs., 11 tabs.

24361 **(NP—8770104) Ceramic heat exchangers for power station firing systems. Final report.** Duerrfeld, H.; Failing, K.H.; Staneff, T.; Steinwandel, J.; Schamm, R. (Steinmueller (L.u.C.) G.m.b.H., Gummersbach (Germany, F.R.); Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1986. 93p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770104/JAW.

Increasing the process efficiency of power stations by higher process temperatures and widening the basis of available resources through the employment of high-ash, inferior grade coals both produce a serious situation with regard to constructional materials, in particular as regards hot corrosion and resistance to erosion. Here the ceramic SiSiC would seem to present an alternative to high-alloy metals. The objective of the project is to discover applications for SiSiC and to employ the material as a heat exchanger element in the realistic conditions presented by the environment of a fluidized-bed furnace in order to ascertain its resistance to corrosion and erosion. Components of differing geometry e.g. straight tubes, hairpin tubes and U-tubes, were developed, manufactured and tested. Straight tubes were tested, both cooled and uncooled, in a fluidized bed under varying fluidization conditions for a period of 200 h. The conclusion was that is was reasonable to consider the manufacture of heat exchanger elements as being feasible very shortly, provided that they were not too complex. Larger components, e.g. with diameters > 42 mm, are at present being developed. What is still lacking is a suitable means of bonding and jointing the ceramic/ceramic transitions. The straight tubes employed in the fluidized-bed furnace remained mechanically stable and suffered no erosive or corrosive damage to speak of during the test period. With 33 refs., 5 tabs., 48 figs..

24362 **(BMFT-FB—02-CT-024-b-Suppl.1-2) Project definition and experimental investigation for a multi-purpose plant for the generation of electricity and production of drinking water and raw materials from seawater. Final report. Supplements 1 and 2.** Uckermann, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 235p. (In German). NTIS (US Sales Only), PC A11. Order Number DE88770094/JAW.

The hybrid-plant for seawater distillation use in a multipurpose plant has been operated in an experimenal investigation in conjunction with a combined MSF/VTE-evaporator (Multistage-Flash Vertical Tube Evaporator) and has been improved to such an extent that the construction of a prototype plant within a demonstration plant can be realized. A new hybrid-process for thermal seawater desalination has been developed. The MSF/VTE-procedure is described by a simulation model. The design of seawater evaporators as well as the demands on the materials have been established. The MSF/VTE-pilot plant has been operated under severe conditions and can be used as a basis for a complete 5 MIGD-MSF/VTE-plant. This volume of the final report consists of two appendices. Appendix 1 describes calculations and mathematical techniques used in the project. Appendix 2 is a description of the computer program used in the project.

24363 **(BMFT-FB—02-CT-024-b-Suppl.3) Project definition and experimental investigation fpr a multi-purpose plant for the generation of electricity and production of drinking water and raw materials from seawater. Final report. Supplement 3.** Schmelzer, P.G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770095/JAW.

The hybrid-plant for seawater distillation use in a multipurpose plant has been operated in an experimental investigation in conjunction with a combined MSF/VTE-evaporator (Multistage-Flash Vertical Tube Evaporator) and has been improved to such an extent that the construction of a prototype plant within a demonstration plant can be realized. A new hybrid-process for thermal seawater desalination has been developed. The MSF/VTE-procedure is described by a simulation model. The design of seawater evaporators as well as the demands on the materials have been established. The MSF/VTE-pilot plant has been operated under severe conditions and can be used as a basis for a complete 5 MIGD-MSF/VTE-plant. This volume contains appendix 3, which describes the completion and enlargement of the fluid flow and thermodynamic program for the MSF/VTE Module.

24364 **(BMFT-FB—02-CT-024-b-Suppl.4-Pt.1) Project definition and experimental investigation for a multi-purpose plant for the generation of electricity and production of drinking wate and raw materials from seawater. Final report. Supplement 4, Part 1.** Zenz, F.R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 196p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88770096/JAW.

The hybrid-plant for seawater distillation use in a multipurpose plant has been operated in an experimental investigation in conjunction with a combined MSF/Vte-evaporator (Multistage-Flash Vertical Tube Evaporator) and has been improved to such an extent that the construction of a prototype plant within a demonstration plant can be realized. A new hybrid-process for thermal seawater desalination has been developed. The MSF/VTE-procedure is described by a simulation model. The design of seawater evaporators as well as the demands on the materials have been established. The MSF/VTE-pilot plant has been operated under severe conditions and can be used as a basis for a complete 5 MIGD-MSF/VTE-plant. This volume contains Part 1 of Appendix 4 which provides a survey of the experimental analysis for the desalination pilot plant.

24365 **(BMFT-FB—02-CT-024-b-Suppl.4-Pt.2) Project definition and experimental investigation for a multi-purpose plant for the generation of electricity and production of drinking water and raw materials from seawater. Final report. Supplement 4, Part 2.** Zenz, F.R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 327p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88770097/JAW.

The hybrid-plant for seawater distillation use in a multipurpose plant has been operated in an experimental investigation in conjunction with a combined MSF/VTE-evaporator (Multistage-Flash Vertical Tube Evaporator) and has been improved to such an extent that the construction of a prototype plant within a demonstration plant can be realized. A new hybrid-process for thermal seawater desalination has been developed. The MSF/VTE-procedure is described by a simulation model. The design of seawater evaporators as well as the demands on the materials have been established. The MSF/VTE-pilot plant has been operated under

severe conditions and can be used as a basis for a complete 5 MIGD-MSF/VTE-plant. This volume contains Part 2 of Appendix 4 which describes the results of the experimental pilot plant program.

24366 **(BMFT-FB—02-CT-024-b-Suppl.5) Project definition and experimental investigation for a multi-purpose plant for the generation of electricity and production of drinking water and raw materials from seawater. Final report. Supplement 5.** Zenz, F.R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 197p. (In German). NTIS (US Sales Only), PC A09. Order Number DE88770098/JAW.

The hybrid-plant for seawater distillation use in a multipurpose plant has been operated in an experimental investigation in conjunction with a combined MSF/VTE-evaporator (Multistage-Flash Vertical Tube Evaporator) and has been improved to such an extent that the construction of a prototype plant within a demonstration plant can be realized. A new hybrid-process for thermal seawater desalination has been developed. The MSF/VTE-procedure is described by a simulation model. The design of seawater evaporators as well as the demands on the materials have been established. The MSF/VTE-pilot plant has been operated under severe conditions and can be used as a basis for a complete 5 MIGD-MSF/VTE-plant. This volume contains Appendix 5 which describes the analytical calculations for the MSF part of the pilot plant.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 25015

24367 **(EP/GE—4/30) Group of experts on the relationship between electricity and the environment report.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 27 Nov 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900391/JAW.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 24359, 24362, 24363, 24364, 24365, 24366

24368 **(EPRI-EL—5635) Development of expert systems as on-line power system operational aids: Final report.** Liu, C.C.; Damborg, M.J. (Washington Univ., Seattle (USA). Dept. of Electrical Engineering). Feb 1988. 82p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920218/JAW.

Expert systems technologies, including hardware and software, have become mature in the last several years. A properly designed expert system can incorporate the expertise of experienced engineers and duplicate human decision-making processes accurately. The purpose of this research is to demonstrate the feasibility of expert system applications in a power system control center environment. In this project, an expert system was developed which serves as a power system dispatchers' assistant during the fault isolation and load restoration process. Results of the expert system development work are provided in this report. The accuracy and efficiency of the developed expert system was validated by utility dispatchers thereby demonstrating the feasibility of the expert system approach. This report includes the evaluation method used and the simultion results as well as a detailed plan for the implementation of expert systems in a real-world control center. 25 refs., 18 figs., 7 tabs.

24369 **(HQ—8702) Hydro-Quebec's development plan. 1987-1988: forecast 1996.** (Hydro-Quebec, Montreal (Canada)). Feb 1987. 169p. (In French). (MICROLOG—87-06039). Hydro Quebec, 75 boul. Dorchester ouest, Montreal, P.Q., Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document describes the long-and short-term goals of Hydro-Quebec in supplying hydroelectricity at a fair rate and meeting the demands of Quebec. Included are scenarios for future planning by reviewing past developments and forecasting trends. Economic and environmental changes are considered. 31 figs., 35 tabs.

24370 **(NYSERDA—88-1) Characteristics of twelve-phase power transmission: Final report.** Stewart, J.R. (Power Technologies, Inc., Schenectady, NY (USA)). Nov 1987. Contract AC05-84OR21400. 202p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88006837/JAW.

High phase order power transmission, particularly twelve-phase, is an option for maximizing power transfer over a right-of-way of given width. This report presents the results of an experimental and analytical program that included construction of a twelve-phase steel lattice portal tower with special insulators, construction of a twelve-phase substation, and subsequent energization of the world's first twelve-phase power transmission line. Impedances, electrical environmental effects (radio noise, audible noise, electric and magnetic fields), and single and three-pole switching are among the parameters measured and evaluated. The twelve-phase line design is compared with existing three-phase designs that are significantly larger for the same power transfer capability. It is concluded that twelve-phase transmission does perform as predicted and that it is an option where space is limited. 68 figs., 42 tabs.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 24115, 24639

24371 **(IAEA-R—4088-F) Digital reactivity meter. Final report for the period 1985 - 1987.** Glumac, B. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). (International Atomic Energy Agency, Vienna (Austria)). Jan 1988. vp. NTIS (US Sales Only), PC Axx/MF A01. Order Number TI88701811/JAW.

Development and test results of two versions of digital computer-based reactivity meters are described in two Jozef Stefan Institut work reports. The first deals with the assumptions that are necessary to assemble a "research", i.e. low cost version of a device that can in real time sample one of the available neutron instrumentation channels of the research reactor and calculate in real time the reactivity of the core, following some assumptions that simplify the necessary calculations. Results of tests using the Institut's TRIGA reactor are presented. The second report describes a "professional" version of the digital reactivity meter that has been used as a tool to ease the low power physics tests necessary to qualify the core design report of a nuclear power plant after refuelling. Some modifications that simplify the calculational procedure have been introduced into the algorithm. Partial results of a "live" performance of this machine in an operating nuclear power plant are also included to confirm the machine's adequacy. Figs and tabs.

24372 **(NUREG—0020-Vol.12-No.1) Licensed operating reactors: Status summary report, Data as of December 31, 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Jan 1988. 506p. NTIS, PC A22/MF A01 - GPO. Order Number TI88900462/JAW.

The US Nuclear Regulatory Commission's monthly Licensed Operating Reactors Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

24373 **(NUREG/CR—2000-Vol.7-No.1) Licensee event report (LER) compilation for month of January 1988.** (Oak Ridge National Lab., TN (USA)). Feb 1988. Contract AC05-84OR21400. 165p. (ORNL/NSIC—200-Vol.7-No.1). NTIS, PC A08/MF A01 - GPO. Order Number TI88004113/JAW.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries. Vendors are those identified by the utility when the LER form is initiated; the keywords for the component, system, and general keyword indexes are assigned by the computer using correlation tables from the Sequence Coding and Search System.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 24383, 24444, 24447, 24460, 24463, 24464, 24465, 24466, 24467, 24489, 24493

24374 (BULBW—1, pp 31-59) **Measurements of the tritium and radio-carbon contents in damaged and undamaged trees.** Muennich, K.O.; Levin, I. (Heidelberg Univ., Germany, F.R. Inst. fuer Umweltphysik). 1987. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752227/JAW. (CONF-8611224—).

From Forum on impact of radioactive materials on the atmospheric pollutant inventory and on the radioactivity uptake by plants; Stuttgart, F.R. Germany (7 Nov 1986).

The additional radio-carbon immission observed in recent plant material in Baden-Wuerttemberg in the vicinity of two nuclear power stations (Obrigheim NPS, PWR and Philippsburg NPS, BWR and PWR) (if it exists at all) was a maximum of a few percent of the 'natural' radioactivity of /sup 14/C. However, the immission values for tritium at Philippsburg in leaf and needle samples from the immediate vicinity (up to about 6 km away) were up to a factor of 100 (in leaf water) or up to a factor of 20 (in the organic substance) above the background value, i.e. (clearly at one point and temporarily) they were one to two orders of magnitude higher than the 'naturally' observed range of variation of tritium. A systematic connection between the degree of damage to tres and the observed /sup 14/C or /sup 3/H immission could not be found at either power station.

24375 **(CONF-8710111—32) Effect of decontamination on aging processes and considerations for life extension.** Diercks, D.R. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005956/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

The basis for a recently initiated program on the chemical decontamination of nuclear reactor components and the possible impact of decontamination on extended-life service is described. The incentives for extending plant life beyond the present 40-year limit are discussed, and the possible aging degradation processes that may be accentuated in extended-life service are described. Chemical decontamination processes for nuclear plant primary systems are summarized with respect to their corrosive effects on structural alloys, particularly those in the aged condition. Available experience with chemical cleaning processes for the secondary side of PWR steam generators is also briefly considered. Overall, no severe materials corrosion problems have been found that would preclude the use of these chemical processes, but concerns have been raised in several areas, particularly with respect to corrosion-related problems that may develop during extended service.

24376 **(EPRI-NP—5479) Application guidelines for check valves in nuclear power plants: Final report.** (MPR Associates, Inc., Washington, DC (USA); Kalsi Engineering, Inc., Sugarland, TX (USA)). Jan 1988. 362p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920223/JAW.

As a result of several events involving check valve malfunctions, the Nuclear Regulatory Commission (NRC) contacted the four NSSS Owners Groups in February of 1986, urging them to take a leadership role in addressing the design, testing, and maintenance of safety related check valves. The development of these guidelines represents a new approach to resolving generic concerns in the industry. This document assembles the best data and information available on the application and limitations of, and inspection techniques for check valves. It is to be considered a guideline for use by utilities in developing a program and its incorporation into maintenance programs.

24377 **(EPRI-NP—5658) EPRI Nondestructive Evaluation Center: Assessment of the intergranular stress corrosion cracking training and qualification program: Interim report.** (Jones (J.A.) Applied Research Co., Charlotte, NC (USA)). Feb 1988. 56p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920221/JAW.

Formal training programs for ultrasonic inspection of boiling water reactor (BWR) piping for intergranular stress-corrosion cracking (IGSCC) have been provided by the EPRI NDE Center since 1983. Separate courses are available for detection and sizing of IGSCC in unrepaired piping. A third course addresses inspection for IGSCC in piping which has been repaired by the weld overlay method. It is the policy of EPRI and EPRI NDE Center management to review these programs periodically, using both expertise internal to the NDE Center staff and from outside sources. This report provides the results of a review of the NDE Center IGSCC ultrasonic inspection training by a group of individuals who have no permanent relationshiip with the NDE Center, but who possess recognized expertise in the subject area.

24378 **(INIS-mf—11649) Investigation of the development and optimisation of cutting loads for the cutting of steel pipes with typical properties and material properties for nuclear power stations. Final report.** Schumann, S.; Freund, H.U.; Hollenberg, K.; Horning, W.; Esser, H.J. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1987. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752662/JAW.

The aim of the project was to develop a type of cutter loading for the cutting of thickwalled steel pipes by explosive technique which, due to its construction and cutting performance, is suitable for use when dismantling pipelines in shutdown nuclear power stations. The loading sleeve is built up of individual linear elements and can be placed as a polygon (e.g. octagon) around pipes of different diameters. A steel pipe with dimensions 610 mm diameter x 36 mm wall thickness (live steam pipe of a German BWR of a new type) was completely and accurately cut using a cutting load sleeve with 1.84 kg of explosive. The great tamping of the cutting loader type developed, minimises the quantity of explosive required and reduces the air shock or blast wave peak pressure to about 30% compared to a charge without tamping. The distance at which the value of peak pressure of the blast wave of 1 bar (which could cause damage) is exceeded, is reduced to 3.0 metres compared to 5.3 metres for an untamped charge of the same cutting power.

24379 **(NUREG/CR—4667-Vol.4) Environmentally assisted cracking in light water reactors: Semiannual report, October 1986-March 1987.** Shack, W.J.; Kassner, T.F.; Maiya, P.S.; Park, J.Y.; Ruther, W.E. (Argonne National Lab., IL (USA)). Dec 1987. Contract W-31109-ENG-38. 75p. (ANL—87-41). NTIS, PC A04/MF A01 - GPO. Order Number TI88006919/JAW.

This progress report summarizes work performed by Argonne National Laboratory on environmentally assisted cracking in light water reactors during the six months from October 1986 to March 1987.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 24128, 24129, 24130, 24131, 24374, 24375, 24376, 24379, 24432, 24434, 24444, 24445, 24446, 24448, 24449, 24450, 24451, 24457, 24459, 24460, 24461, 24462, 24463, 24464, 24465, 24466, 24467, 24469, 24471, 24472, 24473, 24474, 24475, 24476, 24477, 24478, 24479, 24480, 24481, 24482, 24483, 24484, 24485, 24486, 24487, 24488, 24491, 24492, 24502, 24503, 24507, 24508, 24509, 24510, 24728, 24914

24380 **(AEEW-R—1541) CAIN computer code for the generation of MABEL input data sets: a user's manual.** Tilley, D.R. (Imperial Coll. of Science and Technology, London (UK). Dept. of Mechanical Engineering). (UKAEA Atomic Energy Establishment, Winfrith). Mar 1983. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752727/JAW.

CAIN is an interactive FORTRAN computer code designed to overcome the substantial effort involved in manually creating the thermal-hydraulics input data required by MABEL-2. CAIN achieves this by processing output from either of the whole-core codes, RELAP or TRAC, interpolating where necessary, and by scanning RELAP/TRAC output in order to generate additional information. This user's manual describes the actions required in order to create RELAP/TRAC data sets from magnetic tape, to create the other input data sets required by CAIN, and to operate the interactive command procedure for the execution of CAIN. In addition, the CAIN code is described in detail. This programme of work is part of the Nuclear Installations Inspectorate (NII)'s contribution to the United Kingdom Atomic Energy Authority's independent safety assessment of pressurized water reactors.

24381 **(AEEW-R—1980) MABEL-2D: a code to analyse cladding deformation in a loss-of-coolant accident. Part 2. User notes.** Bowring, R.W. (UKAEA Atomic Energy Establishment, Winfrith). Aug 1985. 137p. NTIS (US Sales Only), PC A07/MF A01. Order Number TI88752729/JAW.

The MABEL series of codes is being developed at Harwell to predict the extent of cladding deformation (ballooning) in pressurized water reactor fuel rods during a loss of coolant accident. MABEL - 2D is an updated version of MABEL - 2C. These are user notes for MABEL - 2D (which is described in a separate report AEEW - R1979). They describe the input data specification; the use of the restart facility; debug printing and quick-running sample problems. The input data are divided into rod data, thermal hydraulic data and creep data. There is an input data flow chart. The main appendix gives the detailed input data specification. (U.K.).

24382 **(AEEW-R—2048) TITAN - a 9 MW, 179 bar pressurised water rig.** Mogford, D.J.; Lee, D.H. (UKAEA Atomic Energy Establishment, Winfrith). Feb 1987. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752733/JAW.

The report describes the TITAN rig built at Winfrith for thermal hydraulic experiments with water at up to 179 bar pressure. A power supply of 9 MW is available. The report describes three typical experiments that show the versatility of the rig. The first is a 25 rod pressurized water reactor fuel bundle critical heat flux experiment, the second is a parallel channel evaporator test and the third is a model jet pump test.

24383 **(BNL-NUREG—40748) Operating experience and aging assessment of component cooling water systems.** Lofaro, R.; Subudhi, M.; Higgins, J.; Taylor, J. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 14p. (CONF-8710111—33). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006362/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Aging of Component Cooling Water (CCW) Systems in nuclear plants has been characterized using the Aging and Life Extension Assessment Program (ALEAP) Systems Level Plan developed by Brookhaven National Laboratory. Failure data from various national data bases were reviewed and analyzed to identify predominant CCW failure modes, causes and mechanisms. Time dependent failure rates for major components were calculated to identify aging trends. Plant specific data were obtained and evaluated to supplement data base results. A computer program (PRAAGE) was developed and implemented to model a typical CCW system design and perform PRA calculations. Time dependent failure rates were input to the program to evaluate the effects of aging on component importance and system unavailability. Changes in both component importance and system unavailability with age were observed and are discussed. 10 refs., 15 figs.

24384 **(CEGB-TPRD/B—0885/R86) Operational advantages of enhanced primary circuit clean-up flow rate prior to cold shutdown for refuelling Sizewell 'B'.** Brookes, I.R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Oct 1986. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752770/JAW.

During the course of taking a PWR from power to cold shutdown conditions for refuelling, a large spike of activity appears in the coolant. This paper investigates the way this radioactivity in the coolant changes with time and how the achievement of satisfactorily low levels of activity in the coolant is affected by the rate at which the coolant is filtered and demineralised (clean-up). This is done by establishing a mathematical relationship between activity in the coolant, the time after shutdown and the clean-up rate, using several practical examples to demonstrate the general validity of the relationship and to find numerical values for parameters. The mathematical expression is used to generate the type of activity-time behaviour that could be expected for Sizewell 'B'. By varying the parameters describing the clean-up rate, it is possible to show how much time may be saved by increasing the clean-up flow rate. It is found that augmenting the clean-up flow by either connecting the refuel pool or spent fuel pool clean-up systems in parallel with the cooled, depressurised primary circuit will realise time savings between 1 and 6 days over the range of parameters studied.

24385 **(CEGB-TPRD/B—0940/R87) PWR primary coolant sample lines - problems with measurement of corrosion products and experimental proposals for Ringhals PWR.** Polley, M.V.; Brookes, I.R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jul 1987. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752776/JAW.

Coolant samples are drawn from PWR primary circuits through long narrow tubes. Concern that interaction with the sample line walls (by deposition and release) can result in inaccurate measurement of corrosion product concentrations has recently intensified after several observations of a dependence on sample line flow rate. Particularly significant instances of this have been observed at Ringhals PWR. A further problem is that measured concentrations show spurious transient increases after valving in the sample line. Sampling behaviour is complex since it involves particulate as well as soluble material, and deposition and release as well as localised phenomena associated with crud traps within the sample line. The present report has threefold function, firstly to review instances of anomalous sample line behaviour and secondly to present a basic theoretical background to aid interpretation of such behaviour. The third and most important function is to suggest plant measurements which might be made at Ringhals PWR to understand better the response of the sampling system by quantifying the effects due to corrosion product deposition on, and release from, sample line walls.

24386 **(EPRI-NP—2956) Effectiveness of thermal ignition devices in lean hydrogen-air-steam mixtures.** Tamm, H.; McFarlane, R.; Liu, D.D.S. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). (Electric Power Research Inst., Palo Alto, CA (USA)). Mar 1985. 136p. (AECL—7820). NTIS (US Sales Only), PC A07/MF A01. Order Number TI88701807/JAW.

Deliberate ignition of hydrogen at low concentrations in reactor containment systems is one method of controlling hydrogen during degraded core accidents. Since many postulated accident conditions have substantial amounts of steam present, experiments have been performed to determine the hydrogen-air-steam concentration regimes in which ignitors would be effective. In these ex-

periments, both a GM AC 7G thermal flow plug and a Tayco Model 3442 ignitor have been used. These ignitors have been installed in PWR containments with ice condensers and in BWR Mark III containments. This report presents the results of these ignitor effectiveness experiments, and gives the ignition limits and the effect of steam on the ignitor surface temperatures required for ignition.

24387 **(EPRI-NP—5561-CCM-Vol.1) MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1, User's manual.** Alexander, J.H.; Luu, L. (S-Cubed, San Diego, CA (USA)). Feb 1988. 89p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920222/JAW.

A major problem in the operation of PWR steam generators is corrosion in heated crevices. Estimating the pH of the boiler water as it becomes more and more concentrated in the crevice environment is an important tool to use in preventing corrosion. Measuring the pH of a sample in this harsh environment is difficult under the best of circumstances and, at present, not possible in steam generators. The MULTEQ computer code provides a method for calculating estimates of the changing pH of an electrolytic solution as it is subjected to the process of concentration that takes place in crevices.

24388 **(INIS-mf—11617) Reduction of PWR containment pressure after hypothetical accidents by water-cooling of the outer containment surface - annular space spray system.** Cremer, J.; Dietrich, D.P.; Roedder, P. (Bonnenberg und Drescher Ingenieurgesellschaft m.b.H., Aldenhoven (Germany, F.R.)). Dec 1980. 65p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752031/JAW.

The consequences of a core melt-out accident in the vicinity of a nuclear power station are determined by the integrity of the safety containment. This can be adversely affected by different events during the course of the core melt-out accident. The most important phenomenon is the contact between the melt and sump water. Due to the evaporation of the sump water, there is a continuous rise in pressure of the safety containment, which finally leads to failure due to excess pressure. In order to reduce the fission product release due to the resulting leakage, one must try to reduce the pressure as quickly as possible. As heat cannot be removed from the steel containment to the environment because of the thick concrete containment, it is best to bypass the insulating effect of the concrete by cooling the steel containment from outside. The aim of this investigation is therefore to work out a technically relatively simple system, which offers the possibility of backfitting, setting to work and repair. Such a system is an annular space spray system, by which the annular space between the concrete and steel containment has water pumped to the level of the dome and evenly sprayed over the top hemisphere. Mobile pumps on fire engines belonging to the fire brigade are sufficient to supply the cooling water and these will be available some hours after the accident occurs. The used spray water without any radioactive components is collected outside the reactor building and/or drained off.

24389 **(JAERI-M—87-150) ASSEMBLY-SHIP: a computer code for generating few-group cross-sections for heterogeneous fuel assemblies of a marine reactor.** Itagaki, Masafumi; Naitoh, Yoshitaka; Iijima, Kouichirou; Inoue, Hideaki. (Japan Atomic Energy Research Inst., Tokyo). Sep 1987. 74p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752327/JAW.

A FORTRAN code ASSEMBLY-SHIP has been developed to generate burnup-dependent three-group nuclear constants for use in the core management computations for the nuclear ship MUTSU reactor. This report provides a general description of this code and the input data formats. The code consists of two parts, that is, a module for generating burnup dependent multi-energy group constants and three-group collapsed ones for a lattice-cell, and a two-dimensional diffusion module for producing three-group constants for fuel assembly. The former module is based both on a GAM-type slowing-down program and a newly-modified version of the thermalization transport theory program THERMOS. The diffusion module calculates the three-group neutron flux distribution within a fuel assembly, and produce three-group microscopic and macroscopic cross-sections averaged over the assembly. For the purpose of accurate evaluation of the neutron leakages from a lattice-cell, the fast-group bucklings and the thermal-group albedo introduced for the cell calculation are adjusted iteratively in such a way that the neutron leakages obtained from the cell calculation become consistent to the ones obtained for the cell from the diffusion calculation performed for a fuel assembly. Several benchmark calculations using the nuclear constants produced by this code have been made for the data measured during the MUTSU land-loaded core critical experiment and the data obtained during the hot-zero-power test for the actual MUTSU plant, and the calculated results of critical eigenvalue and power distribution agree well with the measured values.

24390 **(Juel—2149) Contribution on the controllability of reactor cores for nuclear power plants with boiling water reactors demonstrated by KKK.** Brandes, L.P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Aug 1987. 187p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI88752669/JAW.

The international status of load-follow-operation experience for nuclear power plants with boiling-water reactors will be presented in this report. 3 D-core calculations will be used for analysing the influence of different types of core parameters with respect to load-follow capability and will be compared with operational experience. The accuracy and reliability of the calculations will be defined by power distribution measurements. It will be shown, that the requirements for thermal margins (maximum fraction of linear heat generation rate and minimum critical power ratio) and PCI-related operational restrictions in a load-follow operation range of around 50% to 100% thermal power can be complied with.

24391 **(KFKI—1987-57/G) 7.4% cold leg break without high-pressure emergency core cooling system and hydroaccumulators in action. Computerized measurement data processing.** Bazso, Z.; Ezsoel, Gy.; Perneczky, L.; Szabados, L.; Toth, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1987. 108p. (In Hungarian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701945/JAW.

The theoretical works on the investigation of the PMK-NVH experimental facility (the 7.4% cold leg break without HPIS and accumulator operation) are presented. The evaluation of the measured data, the interpretation of the results and the post-test calculations with the RELAP4/mod5 code are summarized. (author) 49 figs.

24392 **(KFKI—1987-73/G) Investigation of the loss of feedwater transient on the PMK-NVH test facility. Computerized measurement data processing.** Szabados, L.; Ezsoel, Gy.; Perneczky, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1987. 133p. (In Hungarian). NTIS (US Sales Only), PC A07/MF A01. Order Number TI88701948/JAW.

The loss of feedwater experiment performed on the PMK test facility is reported. Processing and evaluation of measured data is included. After a brief overview of pre-test calculations, calculated post-test results obtained with the RELAP4/mod6 code are described (author) 3 refs.; 67 figs.

24393 **(ND-R—1432(R)) PWR safety research programme - final report on ultrasonic technique developments for the threaded-hole region in the reactor pressure vessel flange.** Highmore, P.J.; Bann, T. (UKAEA Risley Nuclear Power Development Labs.). (UKAEA Risley Nuclear Power Development Establishment). May 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752784/JAW.

This Report reviews the work carried out on the development of an automated ultrasonic inspection technique for the detection and sizing of flaws in the threaded-hole region of a PWR reactor pressure vessel (RPV) flange. The work has been taken to the stage of producing a laboratory prototype inspection device operat-

ing in conjunction with a computer-based data gathering system. Evaluation of the technique has been carried out on a range of artificial flaws in representative threaded-hole samples.

24394 **(NUREG/CR—4947) Analysis of the A302B and A533B standard reference materials in surveillance capsules of commercial power reactors.** Stallmann, F.W. (Oak Ridge National Lab., TN (USA)). Jan 1988. Contract AC05-84OR21400. 124p. (ORNL/TM—10459). NTIS, PC A06/MF A01 - GPO. Order Number TI88006035/JAW.

The results of Charpy tests for A302B and A533B Standard Reference Materials in surveillance capsules of commercial power reactors are analyzed. The NDT shifts at 30 ft-lb (41 J) generally follow the predictions provided by the draft Revision 2 of Reg. Guide 1.99. Deviations from the predicted values are correlated to similar deviations for the accompanying materials in the same capsules, but large random fluctuations prevent precise quantitative determination. Difference in capsule temperatures is a likely explanation for deviations from Reg. Guide 1.99 predictions. Irradiations of the same materials in the ORR-PSF experiment show similar results, although somewhat larger than predicted embrittlement in the high-fluence, high-fluence-rate SSC2 capsule, which appears to be a fluence-rate effect. Shifts in upper-shelf energy and other measures of embrittlement are not considered in this report.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 24438, 24439, 24440, 24441, 24455, 24456, 24458, 24470, 24495, 24637, 24638, 25069

24395 **(INIS-mf—11618) Challenge of introducing high-temperature reactor plants onto the international power plant market.** Bogen, J.; Stoelzl, D. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)). 1987. 18p. (CONF-870863—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752242/JAW.

From Seminar on small and medium-sized nuclear reactors: safety and licensing issues; Lausanne, Switzerland (24 Aug 1987).

Growth of world population increases energy demand until the year 2000 and afterwards. Electricity growth rates in industrialized nations are lower after the oil price escalation in 1973 and 1979, and in developing countries grid sizes are often too small for the operation of large LWR plants. This indicates a potential for small and medium-sized power reactors such as the HTR-100 and the HTR-500. These plants can compete with coal fired plants of comparable size. An HTR-500 is even competitive, considering the electricity generating cost of large LWR plants. The special advantages of HTR plants in the small and medium-capacity range are discussed.

24396 **(Juel—2131) Potential study to the refinement of coal by steam gasification (SCG) with high temperature reactor (HTR) heat. Increasement of the economical competitiveness by chemical engineering and nuclear engineering designs.** Barnert, H.; Singh, J.; Niessen, H.F.; Neis, H.; Hohn, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). May 1987. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752032/JAW.

Evaluation on the potential to increase the economical competitiveness of the refinement of coal for the process of 'steam coal gasification using high temperature reactor heat' on the basis of the status of development and valuation by chemical engineering and nuclear engineering measures. By gasification in a steam generator of horizontal design, heated with primary helium, lowered pressure of the gasification, slightly elevated helium temperatures and if necessary, partial gasification a large potential to increase the economic competitiveness can be envisaged.

24397 **(Juel—2138) Tritium in HTR systems. An up-to-date appraisal with regard to plant planning and design, engineering and radiation protection.** Steinwarz, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jul 1987. 208p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number TI88752666/JAW.

Starting from the basis of the radiological properties of tritium, the provisions of present-day radiation protection legislation are discussed in the context of the handling of this radionuclide in HTR plants. Tritium transportation is then followed through from the place of its creation up until the sink, i.e. disposal and/or environmental route, and empirical values obtained in experiments and in plant operation translated into guidelines for plant design and planning. The use of the example of modular HTR plants permits indication that environmental contamination via the 'classical' routes of air and water emissions, and contamination of products, and resulting consumer exposure, are extremely low even on the assumption of extreme conditions. This leads finally to a requirement that the expenditure for implementation of measures for further reduction of tritium activity rates be measured against low radiological effect.

24398 **(Juel—2143) Development and application of a two-dimensional computer code for the investigation of the transient behaviour of a steam reformer with segmental baffles.** Brab, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jul 1987. 253p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number TI88752667/JAW.

This study deals with the theoretical description of heat transport and flow distribution in a helium-heated steam reformer with segmental baffles. For this purpose a two-dimensional, transient computer code is developed, which is described in detail. A first application of this code is demonstrated by designing an 8.25 MW steam reformer for the planned AVR-process heat plant. In a parameter study the sensitivity of such a heat exchanger to the variation of some constructional features is demonstrated and the above mentioned 8.25 MW steam reformer is optimized by the aid of the so gained knowledge. Finally the transient behaviour of the hot gas duct and the steam reformer of the AVR-process heat plant during start up is investigated. It is shown, that, from the technical point of view, it will be possible to start operating the process heat loop with a helium temperature above 600degC while keeping within safety requirements.

24399 **(Juel—2147) Stress analysis of a HTR topreflector exemplified for the AVR-reactor.** Bergerfurth, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jul 1987. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752668/JAW.

Because of its high gas outlet temperature, the HTR reaches beyond sheer power production and open up long-range prospects in the field of new coal refining techniques. The AVR-reactor is remarkably suited to be used for nuclear process heat due to its infrastructural and scientific insertion into the Kernforschungsanlage Juelich. To decide whether or not the AVR-reactor should continue operation or be remodelled into a process heat plant, the present state and the expectation of life for the whole facility has been analysed by many detailed investigations. This study deals with the increase of stress in the AVR topreflector with respect to the past service life history, and provides results on stresses which cover a convenient spectrum of reactor operations in the future. The calculations have been done with a three-dimensional geometry in consideration of the anisotropy material behavior and the influence of creep by radiation. Using adequate stress criteria it can be stated, even though conservative assumptions were taken into account, that a sufficient expectation of life for the topreflector can be warranted.

24400 (Juel—2155) Investigations on power increase of high temperature reactors with inherent safety characteristics by optimization of the core layout. Fricke, U. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Duisburg Univ. (Gesamthochschule) (Germany, F.R.)). Aug 1987. 179p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI88752670/JAW.

The HTR-module is a pebble bed reactor with excellent safety properties but with a power limitation of 200 MW(th). Starting with the module-safety concept possibilities for power increase and hereby improvement of economy of small HTR's are investigated. For this many calculations were performed and systematically analyzed, so that the following approximate formulae were developed. θ/sub max/ = f (H, D, L, core geometry, loading ...). By the application of alternative core geometries as plate core, ring-shaped core, segment of ring-shaped core and cylindrical core with nozzles, also in the medium power range ($\simeq$ 1000 MW(th)) reactors can be constructed, which exclude a damage of the coated particles during an heat-up accident with depressurization (θ/sub max/ $\leq$ 1600degC).

24401 Exact solutions to gaseous flow time and temperature dependent parent and first-daughter fission-product plateout problems. Durkee, J.W. Jr.; Lee, C.E. (Los Alamos National Lab., NM (USA); J.T.A. Inc., Sandia Park, NM (US)). *Annals of Nuclear Energy;* **14**: No. 8, 391-446(1987).

Exact solutions are obtained to the parent and first-daughter time and temperature dependent convective-diffusion equations with radioactive decay in an axisymmetric cylindrical conduit. Time invariant nominal gaseous flow conditions are assumed for which piecewise polynomial spatial representations of the axial temperature distribution are considered. The time dependence of the daughter-product inlet concentration due to parent decay is included. A mass transfer model incorporating these solutions is developed to predict the fission-product plateout on the conduit wall. The temperature dependence of both the diffusion and wall mass transfer coefficients is characterized using Arrhenius relationships. Comparison with experimental /sup 134/Cs, /sup 137/Cs, and /sup 131/I data demonstrates model viability in correctly predicting temperature dependent plateout under relevant flow conditions.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

24402 (AEEW-R—2193) Full length cluster level swell data at pressures from 2 to 40 bar. Pearson, K.G. (UKAEA Atomic Energy Establishment, Winfrith). Nov 1987. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752740/JAW.

This paper gives results of level swell experiments at pressures up to 40 bar, performed at Winfrith in 1981 as described elsewhere. The results have been used by a number of workers to develop voidage correlations and to assess safety codes. The experiment and experimental rig used are described. The results are tabulated.

24403 (INFO—0152) Feasibility study of a thermosyphoning rig. Amrouni, J.-C.; Nijhawan, S. (Idea Research, Toronto, Ontario (Canada)). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Feb 1985. 258p. NTIS (US Sales Only), PC A12/MF A01. Order Number TI88701924/JAW.

This report covers the work performed to generate a conceptual design of a thermosyphoning test facility. Scaling methods have been reviewed; and a two phase scaling technique has been applied to determine the geometry and specifications of the facility. The instrumentation and the data acquisition systems have been defined such as to provide the most needed information on two phase thermosyphoning phenomena. Particular attention has been paid to the scaling of the primary heat transport system which consists of a figure-of-eight loop with five channels per pass and seven half-length, full-diameter heater elements per channel. The facility can be defined as 'half-length, half-height facility' with decay power capabilities for the primary system and full power for the secondary system.

24404 (OH—84-16-K) Nondestructive and fracture evaluation section: 1983 review and 1984 work program. Baron, J.A. (Ontario Hydro Research Lab., Toronto (Canada)). 8 Feb 1984. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701954/JAW.

The projects and achievements of the Nondestructive and Fracture Evaluation Section in 1983 are reviewed. Proposed projects and objectives for 1984 are described in outline.

24405 (OH—84-98-K) Applied structural and solid mechanics section: 1983 review and 1984 programs. Chadha, J.A. (Ontario Hydro Research Lab., Toronto (Canada)). 13 Apr 1984. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701959/JAW.

This report reviews briefly the applied research and problem solving work carried out by the Applied Structural and Solid Mechanics Section during 1983. In 1983 there was a strong demand for services in the areas of theroretical and experimental stress analysis, heat transfer analysis, nonlinear analysis, and general structural analyses related to nuclear and thermal power plant, and transmission line components. Development of capabilities in these areas progressed well. Proposed work programs for 1984 are outlined in this report.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 24443, 24452, 24463, 24893

24406 (CEA-DRNR-P—350) R and D in support of the 1500 MWe fast neutron reactor in the light of the experience gained on Super Phenix. Fremont R. de; Lions, N.; Lemercier, G. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Sep 1986. 10p. (CONF-860917—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752170/JAW.

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

The French Breeder Reactor program has been carried out since 1958 with gradual progress and continuity. After the construction and successful operation of RAPSODIE and PHENIX and the present completion and startup of SUPER PHENIX in Creys Malville, the detailed preliminary design of a 1500 MWe plant is under study with emphasis on cost reduction. The selection of new technical options and simplifications has led to a coherent and relatively large R and D program. The methodology used for the study, the choice and the validation of these options is given and illustrated by significant examples.

24407 (CEA-DRNR-P—352) Racine-1e critical experiments for control-rod method and data validation experimental and calculation results. Giese, H.; Cavarec, C.; Palmiotti, C.; Granget, C. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Sep 1986. 16p. (CONF-860906—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752168/JAW.

From Advances in reactor physics and safety meeting; Saratoga Springs, NY, USA (17 Sep 1986).

This paper summarizes the results of control rod experiments, performed in the heterogeneous double ring core RACINE-1E, investigated as part of the RACINE programme at the French zero-power-facility MASURCA. Measurements were made using both natural and highly enriched boron carbide adsorbers and comprised subcritical and critical experiments. The analysis was carried out using methods similar to those used by CEA for the prediction of rod worths in LMFBR power reactors.

24408 **(CEA-DRNR-P—359) French experience concerning the contamination by inactive and radioactive impurities and the purification of the cover gas of LMFBRs.** Clerc, R.; Michaille, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Sep 1986. 42p. (CONF-8609227—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752171/JAW.

From IAEA specialists meeting on fast reactor cover gas purification; Richland, WA, USA (24 Sep 1986).

In this paper the authors describe, for Rapsodie, Phenix and Super Phenix reactors, the cover gas pipe works, the cover gas purification techniques and give for Rapsodie and Phenix the levels of contamination and the problems created by sodium aerosols.

24409 **(CEA-DRNR-P—365) LARA: Expert system for acoustic localization of robot in a LMFBR.** Lhuillier, C.; Malvache, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Dec 1986. 15p. (In French). (CONF-861265—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752167/JAW.

From Intelligent autonomous systems international conference; Amsterdam, Netherlands (8 Dec 1986).

The expert system LARA (Acoustic Localization of Autonomic Robot) has been developed to show the interest of introducing artificial intelligency for fine automatic positioning of refuelling machine in a LMFBR reactor. LARA which is equipped with an acoustic detector gives rapidly a good positioning on the fuel.

24410 **(WAPD-TM—1607) End-of-life examinations of Light Water Breeder Reactor grids and other module structural components (LWBR Development Program).** Smith, B.C. (ed.); Clayton, J.C.; Pitcairn, T.N.; Richardson, K.D.; Smith, B.C.; Wargo, J.E. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Oct 1987. Contract AC11-76PN00014. 255p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88006921/JAW.

End-of-Life examinations were performed on LWBR core structural components which had important influence on mechanical stability of fuel elements duing core performance. These components included: (1) AM-350 stainless steel grid sections to assess corrosion, stress relaxation, braze performance, and dimensional stability; (2) a 348 stainless steel flux thimble tube which failed in service; (3) various Inconel X-750, Inconel-600, 17-4 PH, and AM-350 bolts; (4) Zircaloy-4 module shells and screws; (5) Inconel-600 module cover plates and baseplates; (6) 304 stainless steel Bypass Inlet Flow Supply Tube; (7) 17-4 PH shear keys and Inconel-600 struts; (8) Zircaloy-4 module support posts; (9) seed module support shaft and balance piston. Examinations included visual inspection and, in some cases, dye penetrant and metallography. Threaded fasteners remained uncracked to end-of-life (EOL). Grid dimensions showed minor changes at EOL. Grid springs exhibited good stress relaxation characteristics. Corrosion resistance of core components was adequate, and components were relatively free from crud buildup.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 24496, 24497

24411 **(EGG-M—25786) Requirements and cost considerations for a Combined Space Nuclear Reactor Test Facility.** Harvego, E.A.; Park, D.L.; Ramsthaler, J.H.; Reed, W.C.; Whitbeck, J.F.; Gillies, B.B. (EG and G Idaho, Inc., Idaho Falls (USA); Rockwell International Corp., Canoga Park, CA (USA). Energy Technology Engineering Center). 1987. Contract AC07-76ID01570. 31p. (CONF-870102—32). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006763/JAW.

From 4. symposium on space nuclear power systems; Albuquerque, NM, USA (12 Jan 1987).

A number of US military programs are currently considering nuclear power systems for space propulsion and electric power applications. These space power systems will each require expensive ground testing of nuclear components and systems prior to deployment in space. In some cases, the ground test facility construction and operating costs can represent a major portion of the total program budget. To minimize the costs to individual programs, consideration is given to the potential for reducing total costs by constructing a single facility in which two or more test programs can be conducted simultaneously. This concept is referred to as a Combined Space Nuclear Reactor Test Facility. This paper presents the results of a study in which the requirements and costs associated with conducting two space nuclear reactor ground test programs separately and in combination were examined. The findings of this study were that, for all new construction, the costs associated with construction and operation of a combined Space Nuclear Reactor Test Facility were substantially less than those associated with constructing and operating separate facilities. However, if existing test support facilities can be used, the potential costs of the two options are comparable. 11 refs., 5 figs., 2 tabs.

24412 **(EGG-TFM—7925) ATHENA radiation model.** Shumway, R.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1987. Contract AC07-76ID01570. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006782/JAW.

The ATHENA computer program has many features that make it desirable to use as a space reactor evaluation tool. One of the missing features was a surface-to-surface thermal radiation model. A model was developed that allows any of the regular ATHENA heat slabs to radiate to any other heat slab. The view factors and surface emissivities must be specified by the user. To verify that the model was properly accounting for radiant energy transfer, two different types of test calculations were performed. Both calculations have excellent results. The updates have been used on both the INEL CDC-176 and the Livermore Cray. 7 refs., 2 figs., 6 tabs.

24413 **(SAND—87-1922C) MACRAD: A mass analysis code for radiators.** Gallup, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-880122—9). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005743/JAW.

From 5. symposium on space nuclear power systems; Albuquerque, NM, USA (11 Jan 1988).

A computer code to estimate and optimize the mass of heat pipe radiators (MACRAD) is currently under development. A parametric approach is used in MACRAD, which allows the user to optimize radiator mass based on heat pipe length, length to diameter ratio, vapor to wick radius, radiator redundancy, etc. Full consideration of the heat pipe operating parameters, material properties, and shielding requirements is included in the code. Preliminary results obtained with MACRAD are discussed.

24414 **Pellet bed reactor design for space power.** El-Genk, M.S.; Parlos, A.G.; McGhee, J.M.; Lapin, S.; Buden, D.; Mims, J. (Univ. of New Mexico, Albuquerque, NM). pp 478-484 of Proceedings of the 22nd intersociety energy conversion engineering conference. New York, NY; American Institute Aeronaut and Astronaut (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Technical Paper 879360.

This paper presents the results of a design and optimization study of the Pellet bed reactor system concept (PBRSC) for meeting the power needs of some of the Strategic Defense Initiative missions during both alert and burst modes of operation. The proposed system consists of four modules, each is capable of providing up to 165 MWe during the burst mode and 3.3 MWe during the alert mode. This modular approach provides redundancy, with minimum mass penalty, and it increases the survivability of the power plant by making it necessary for an attack force to destroy many independent power modules. Results indicated that a hydrogen cooled Pellet Bed Reactor (PBR)/potassium Rankine cycle system (power density of 3.8 kWe/kg) is superior to a closed loop Brayton cycle system (power density of 3.1 kWe/kg), but comparable with an open-loop Brayton cycle system. For the closed Brayton cycle system, the compressor power requirements are about 10 times

higher than those for Rankine cycle system resulting in a higher reactor power and size and a lower system specific power. Also, the savings in the radiator mass because of the higher efficiency of the closed Brayton cycle system (20% vs. 17% for Rankine cycle system) is offset by the higher heat rejection load. For the open-loop Brayton cycle system, however, the masses of the hydrogen tank and the refrigeration unit are comparable to those of the radiator and of the vapor generator for the Rankine cycle system.

2107 Regulation And Licensing

24415 **(NUREG—0540-Vol.9-No.12) Title list of documents made publicly available, December 1-31, 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Publications Services). Feb 1988. 376p. NTIS, PC A17/MF A01 - GPO. Order Number TI88900460/JAW.

This document is a monthly publication containing descriptions of information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. The following indexes are included: Personal Author, Corporate Source, Report Number, and Cross Reference to Principal Documents.

24416 **(NUREG—0750-Vol.25-Index.2) Indexes to Nuclear Regulatory Commission issuances, January-June 1987.** (Nuclear Regulatory Commission, Washington, DC (USA)). Feb 1988. 79p. NTIS, PC A05 - GPO. Order Number TI88900472/JAW.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Appeal Panel (ALAB), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions of Rulemaking are presented in this document. These digests and indexes are intended to serve as a guide to the issuances.

24417 **(NUREG—0750-Vol.26-No.4) Nuclear Regulatory Commission issuances, October 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Publications Services). Oct 1987. 143p. NTIS, PC A07/MF A01 - GPO. Order Number TI88900459/JAW.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

24418 **(NUREG—0936-Vol.6-No.4) NRC regulatory agenda: Quarterly report, October-December 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Rules and Records). Feb 1988. 101p. NTIS, PC A06/MF A01 - GPO. Order Number TI88900310/JAW.

The Regulatory Agenda is a quarterly compilation of all rules on which the NRC has proposed, or is considering action as well as those on which it has recently completed action, and all petitions for rulemaking which have been received and are pending disposition by the Commission.

2108 Economics

24419 **(INIS-mf—11135) 1983 annual report.** (Ontario Hydro, Toronto (Canada)). 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701936/JAW.

During 1983 Ontario Hydro supplied 106.1 billion kilowatt hours of electricity, a 5.2 percent increase over 1982. The year's primary peak demand of 18.8 million kW on December 21 was also a record. Hydro's CANDU nuclear units supplied 38.3 billion kWh, a 10 percent increase over 1982 and 32.5 percent of the total energy generated and purchased. Hydroelectric units supplied 31 percent of total energy made available, and coal-fired plants produced 30.4 percent. Ontario Hydro's total cost of generating one kWh from nuclear stations averaged 1.87 cents in 1983, compared to 3.45 cents for electricity from fossil stations. Providing electricity at a cost of 0.58 cents per kWh, the hydroelectric generating stations remained the least expensive.

24420 **(INIS-mf—11136) 1984 annual report.** (Ontario Hydro, Toronto (Canada)). Apr 1985. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701937/JAW.

Ontario Hydro supplied 122.9 billion kilowatt-hours of electricity in 1984 to meet provincial and export demands. Total primary energy demand was 112.3 billion kWh, an increase of 5.9 percent. The year's peak demand of 18.9 kW occurred on January 12. In 1984 nuclear generating stations produced 40.4 billion kWh, 32.8 percent of the total energy supplied by Ontario Hydro. The additional output of two new nuclear units, Pickering-6 and Bruce-6, more than offset the loss of production caused by Pickering units 1 and 2 being out of service all year for retubing. In May, Atomic Energy of Canada Ltd. removed its Douglas Point nuclear station from service since it was no longer economic to operate the station. Nuclear plants produced electricity at an average cost of 2.2 cents per kWh, compared to 3.4 cents for fossil-fuelled plants.

24421 **(JAERI-M—87-189) Status of emission release and associated problems in energy systems analysis.** Yasukawa, Shigeru; Mankin, Shuichi; Sato, Osamu; Koyama, Shigeo; Ihara, Seijiro. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752347/JAW.

OECD/IEA/ETSAP (Energy Technology System Analysis Project) has been started in March 1976. Since initiation of the projects, JAERI and ETL (Electrotechnical Laboratory) have been participating in the projects as operating agent of Japan. From last October, the ETSAP has initiated its Annex III programme, which pursues the problems laid down in energy-environment relationships. Main research objective of the programme is to investigate through the systems analysis "how various environmental constrains would affect the pattern of fuel and technology use and the choice and timing of implementation of abatement technologies". In this report, we describe the status of emission release in Japan and associated problems in energy system analysis which has been investigated at the start of these research programme mentioned above.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 24639

24422 **(Juel—2100) Removal of gaseous impurities from the primary circuit in high temperature reactors with cerium-mischmetal-getters.** Heinen, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Nov 1986. 169p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88752040/JAW.

The use of getters to remove tritium and other gaseous impurities (especially H/sub 2/, N/sub 2/ and CO) from helium circuits in nuclear reactors has been investigated. The loading capcity of beds, containing small cerium-mischmetal chips has been tested for several typical conditions. The results show that it is possible to use getters to purify inert gas streams for given boundary conditions. High CO-levels, however, lead to a poisoning (passivation) of the getter material. The effect of poisoning is cumulative. A mathematical model describes the behavior of CO in this kind of getter. Safety tests under possible accident conditions were made with the highly reactive cerium-mischmetal chips. The results show that there isn't a critical problem in using this material in the form of a chemical reactive getter bed near a nuclear reactor in the investigated range of accident conditions.

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 24428, 24498, 24499, 24500, 24501

2202 Components And Accessories

REFER ALSO TO CITATION(S) 24468, 24896

24423 **(BNL-NUREG—40746) Improving motor reliability in nuclear power plants.** Subudhi, M.; Taylor, J. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 5p. (CONF-8710111—34). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006363/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Despite the fact that motors are proven to be relatively reliable components and maintenance practices are extensive, motors still experience failures. The operating experience of motors in nuclear power plants clearly indicates that the insulating system and bearing assembly are the dominant failure modes, accounting for almost seventy percent of the reported failures. Maintaining and monitoring the state of these two subcomponents, using costeffective techniques, could eliminate many untimely failures and thus could improve the overall motor reliability and, hence, the plant safety. This paper discusses the results of the motor study performed under the auspices of the NRC Nuclear Plant Aging Research (NPAR) program. The study included determination of appropriate functional indicators suitable for monitoring the condition of the above-mentioned two subcomponents. This was achieved by performing various bearing and insulation tests on aged motors and evaluating various test procedures.

24424 (INIS-mf—11128, pp 21-26) **Optimizing quality control programs for production and operation of nuclear power plant equipment.** Kawalec, M. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

24425 **(INIS-mf—11614) 2D/3D program. Upper plenum test facility - UPTF. Test No. 1. Fluid-fluid mixing test. Quick look report.** (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Abt. Verfahrenstechnik). Jan 1987. 86p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88752028/JAW.

Test No.1 was a quasi-steady state, separate effect test involving the UPTF-System with blocked break valves and blocked pump simulators. Initially the test vessel, the cold and hot leg nozzels as well as the pump seals were completely filled witht hot water in this test. This test was designed to investigate the fluid-fluid mixing phenomena and the development of the fluid and wall temperature fields in the cold leg and downcomer region of a PWR. The experiment was performed by injecting a cold water stream into one cold leg of UPTF while the system was initially filled with stagnant hot water.

24426 **(KFK—4192) Critical two-phase flow through rough slits.** John, H.; Reimann, J.; Eisele, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Oct 1987. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88752022/JAW.

The knowledge of the two-phase mass flow rate through a crack in the wall of nuclear or chemical reactor components is very important under the leak-before-break criterion point of view. For providing a qualified analytical tool for calculating critical mass flow rates through such a crack a detailed test program was carried out using subcooled water up to pressures of 14 MPa. A real crack and several simulated cracks (rough slits) were examined experimentally. The important parameters such as inlet pressure, subcooling temperature of water, slit width, and inner surface roughness were varied in a wide range and the measured data compared with calculated values from different models. The data comparison indicates that the model published by Pana leads to predictions which agree best with the observed data. First calculations were carried out using the friction coefficient zeta, which results from single phase flow measurements. A correlation has been developed to calculate zeta from the geometrical dimensions of the crack and was integrated into an advanced version of the Pana model. The modified Pana model was qualified against some hundreds of test values. The measured data were predicted with a relative standard deviation of less than 20%.

24427 **(KFK—4321) Test facility for fast gas injections into a vessel filled with water.** Wilhelm, D.; Kirstahler, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Nov 1987. 161p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number TI8752674/JAW.

The Fast Gas Injection Facility (SGI) was set up to study the hydrodynamics during the expansion of a gas bubble into a vessel filled with water. The gas stored in a pressure vessel expands against gravity through a circular duct into a large cylindrical vessel partly with water. This report covers the description of the test facility and the data acquisition. Results of the first test series are added.

24428 **Analysis of transient contacting in the low temperature film boiling regime. Part I: Modeling of the process.** Farmer, M.T.; Jones, B.G.; Spencer, R.W. (Dept. of Nuclear Engineering, Univ. of Illinois at Urbana-Champaign, Urbana, IL (USA)). pp 23-30 of Nonequilibrium transport phenomena. Dobran, F.; Bankoff, S.G.; Chen, J.C.; El-Genk, M.S. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870816—).

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

In Part I of this paper, a phenomenological model of the transient contacting process in the low temperature film boiling regime for flat plate geometries is proposed. Based on this model, approximate equations are developed for the case of saturated liquid which describe the duration of contact, local heat transfer due to contact, and surface area wetted as a result of transient contact. With these results, equations are developed which predict the local liquid-contact-time fraction, and the local liquid-contact-area fraction. A surface thermal recovery time, as opposed to the classical wave theory approach, is proposed as a basis for characterization of the minimum point. Based on this postulate, an approximate expression is developed which predicts the minimum film boiling temperature. Qualitative trends predicted by the model are then discussed.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 24435

24429 **(DOE/OR/00033—T393) Biaxial creep of zircaloy: Texture and temperature effects.** Daugherty, W.L. (North Carolina State Univ., Raleigh (USA). Dept. of Nuclear Engineering). 1988. Contract AC05-76OR00033. 229p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88006516/JAW.

Zircaloy is commonly used as a cladding material for nuclear fuel elements. The cladding is subject to time-varying multiaxial stresses in service and the ability to accurately predict cladding behavior is necessary to maintain fuel integrity. This work investigates the biaxial creep behavior of recrystallized zircaloy at three temperatures and with four different crystallographic textures. In addition to measuring the creep behavior, the crystallographic texture is used to independently predict the creep behavior. 48 refs.

24430 **(SRD-R—341) Estimation of missile velocities following the failure of a vessel containing high temperature pressurised water.** Hunt, D.L.M.; Wood, A.J. (UKAEA Safety and Reliability Directorate, Culcheth; Ministry of Defence, Foulness (UK). Atomic Weapons Research Establishment). (UKAEA Safety and Reliability Directorate, Culcheth). Aug 1987. 56p. Safety and Reliability Directorate, Wigshaw Lane, Culcheth, Warrington, WA3 4NE. Price Pound 5.00.

A theoretical model is described which predicts the velocities of missiles produced by the failure of a vessel containing water at high pressure and temperature. The model allows for the lack of thermal equilibrium between the vapour and liquid phases during rapid depressurisation. A series of tests on the failure of tubular vessels is described. The theoretical model is shown to give results which agree well with these and other experimental data.

24431 **Innovative HEPA filter designs to reduce waste generation and simplify waste treatment.** Oma, K.H.; Ross, W.A.; Smith, W.L.; Adams, J.R. (Pacific Northwest Lab., Richland, WA 99352). pp 599-608 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The treatment and disposal of spent high-efficiency particulate air (HEPA) filters has presented a problem at some defense production plants and could be a problem at potential future spent-fuel consolidation or fuel-reprocessing facilities. During studies of transuranic (TRU) waste treatment options conducted by Pacific Northwest Laboratory, it was concluded that treatment of spent HEPA filters would become easier and less costly if some modifications were made to the present materials of construction and design. This study was undertaken to develop and evaluate alternative materials and innovative designs for HEPA filters, making them more compatible with volume reduction technology. The following treatment options were selected for this study: 1) no treatment; 2) compaction; 3) supercompaction; 4) incinerate and melt; and 5) separate the frame from the media and dispose of the frame as low-level waste, and incinerate and melt the filter media and sealant. Forty HEPA design concepts were identified and evaluated by means of a figure-of-merit methodology for technical performance and an economic evaluation that considered filter fabrication and disposal costs. Results of the study indicate that if improved HEPA designs are combined with volume reduction treatments, the costs of filter disposal can be reduced substantially over the use of standard-flow filter designs with no volume reduction treatment. It is estimated that by combining the new design concepts with waste volume reduction treatments, manufacturing and disposal costs can be reduced by $290 or more per filter if classified as low-level waste (LLW) and up to $23,000 per filter if it is high-activity waste (containing activity greater than class-C LLW) and requires repository disposal.

2204 Control Systems

REFER ALSO TO CITATION(S) 24195, 24442, 24495, 24504

24432 **(AEEW-R—1991) Silver-indium-cadmium control rod behaviour during a severe reactor accident.** Bowsher, B.R.; Jenkins, R.A.; Nichols, A.L.; Rowe, N.A.; Simpson, J.A.H. (UKAEA Atomic Energy Establishment, Winfrith). Apr 1986. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752730/JAW.

An alloy of silver, indium and cadmium is commonly used as control rod material in pressurised water reactors (PWRs). The behaviour of this alloy has been studied in a series of experiments using an induction furnace to achieve temperatures up to 1900K. The aerosols released from overheated clad and unclad control rod samples have been characterised in both steam and inert atmospheres. Mass balance experiments have been undertaken to determine the distribution of the control rod alloy constituents following rupture of the cladding, and this work has been supported by thermogravimetric studies of silver-indium mixtures. Metallographic studies were also undertaken to assess the failure mode of the stainless steel cladding and the interaction of the molten alloy with Zircaloy. The results of this work are discussed in terms of aerosol/vapour behaviour during severe reactor accidents.

24433 **(INIS-mf—11610) 2D/3D-project, calibration of the UPTF tieplate flow module with 'advanced instrumentation' and investigation of the function from the CORE simulator feedback control system with break-thru-detectors. Final report.** Simon, U.; Paul, J.; Schorsch, R.; Werner, K.D.; Liebert, J.; Emmerling, R.; Hertlein, R. (Kraftwerk Union A.G., Erlangen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1986. 183p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88752023/JAW.

Instruments of the Advanced Instrumentation for the use in UPTF-Mannheim were calibrated with single-phase and two-phase flow. An algorithm based on the physics was developed which identifies the flow regimes in UPTF and permits to calculate the local water- and steam mass flow rates through the tie plate with good accuracy. The feedback-control-system was examined with original components of UPTF. The control-system reacts to the break-through-detector-signal sufficiently fast and without oscillations. With 5 refs., 5 tabs., 91 figs..

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 24201, 24367, 24374, 24445, 24446, 24448, 24464, 24467, 24493, 24494, 24506

24434 **(DOE/SSDP—0032) A Quality Assurance Program for decommissioning.** Briggs, P.M. (General Electric Co., Shippingport, PA (USA)). 28 Oct 1986. Contract AC06-76RL01857;AC06-84RL10421. 4p. (CONF-880465—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88005298/JAW.

From Pittsburgh quality conference; Monroeville, PA, USA (15 Apr 1988).

Defining the Quality Assurance Program for the US Department of Energy Shippingport Station Decommissioning Project (SSDP) was a unique opportunity because this is the first full-sized commercial nuclear power plant to be decommissioned. General Electric Company defined a Quality Assurance Program that provided adequate control, yet was stripped down to the essentials. The Program is designed to provide a flexible degree of monitoring of subcontractor work, built around a core of radiation safety monitoring, detailed planning, inspection and auditing, and operated with a minimum of dedicated personnel. This paper will concentrate on the traditional quality assurance activities, leaving radiation and environmental monitoring for other presentations.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 24394, 24452, 24494

24435 **(CONF-8709189—8) Conversion, core redesign and upgrade of the Rhode Island Atomic Energy Commission Reactor.** DiMeglio, A.F.; Matos, J.E.; Freese, K.E. (Rhode Island Atomic Energy Commission, Narragansett (USA). Rhode Island Nuclear Science Center; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005919/JAW.

From International RERTR meeting; Buenos Aires, Argentina (28 Sep 1987).

The 2 MW Rhode Island Atomic Energy Commission reactor is required to convert from the use of High Enriched Uranium (HEU) fuel to the use of Low Enriched Uranium (LEU) fuel using a standard LEU fuel plate which is thinner and contains more uranium-235 than the current HEU plate. These differences, coupled with the fact that the conversion should be accomplished without serious degradation of reactor characteristics and capability, has resulted in core design studies and thermal hydraulic studies not only at the current 2 MW but also at the maximum power level of the reactor, 5 MW. In addition, during the course of its 23 years of op-

eration, it has become clear that the main uses of the reactor are neutron scattering and neutron activation analysis. The requirement to convert to LEU presents an opportunity during the conversion to optimize the core for the utilization and to restudy the thermal hydraulics using modern techniques. This paper will present the preliminary conclusions of both aspects.

24436 (INIS-mf—11128, pp 34-37) **Crack detection inspection of components of WWR-S reactor primary circuit.** Plasek, J. 1986. (In Slovak). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

24437 **(JAERI-M—87-146) Annual report on operation, utilization and technical development of research reactors and hot laboratory, from April 1, 1986 to March 31, 1987.** (Japan Atomic Energy Research Inst., Tokyo). Sep 1987. 225p. (In Japanese). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88752316/JAW.

Activities of the Department of Research Reactor Operation in fiscal year 1986 are described. The department is responsible for operation and maintenance of JRR-2, JRR-4, Research Reactor Development Division which performed upgraded JRR-3 and other R and D, and Hot Laboratory. In the above connection various other work has also been performed, such as technical management of fuel and coolant, radiation control, irradiation technique, etc. In Hot Laboratory, we have performed post-irradiation examinations of fuels and materials, and also development of examination procedures, too.

2208 Propulsion Reactors

REFER ALSO TO CITATION(S) 24411

2209 Reactor Safety

REFER ALSO TO CITATION(S) 24638, 24896, 25028, 25069, 25473

24438 **(BMU—1987-168/1-2) Chernobyl reator accident and its consequences. Informative report prepared on behalf of the IAEA meeting, Vienna, August 25-29, 1986. Pt. 1 and 2. Pt. 1: General material. Pt. 2: Appendix 1-7.** (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Aug 1986. 449p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, Germany, F.R.

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.; Translated from Russian. Published in 2 separate volumes.

GRS has revised the German translation of part 1 of the report on the Chernobyl reactor accident. The translation is technically clear and intelligible and contains the current technical terms. The report comprises a description of RBMK-1000, a chronological description of the accident, the analysis of the accident, the causes of the accident, measures preventing the further development of the accident as well as measures controlling the radioactive contamination of the environment and the population. The report discusses immediate emergency measures improving the safety of RBMK-type nuclear power plants and deals with recommendations for nuclear safety engineering.

24439 (BULBW—1, pp 13-20) **External radiation contamination of plants from Chernobyl.** Kaspar, D. (Ministerium fuer Ernaehrung, Landwirtschaft, Umwelt und Forsten des Landes Baden-Wuerttemberg, Stuttgart, Germany, F.R.). 1987. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752227/JAW. (CONF-8611224—).

From Forum on impact of radioactive materials on the atmospheric pollutant inventory and on the radioactivity uptake by plants; Stuttgart, F.R. Germany (7 Nov 1986).

If one compares the values of natural external radiation contamination, which often vary greatly in a small space, with the calculated values, which are caused by emission from nuclear powerstations, then even with unfavourable assumptions, there is a differene of several orders of magnitude. Due to the Chernobyl accident, a huge outdoor experiment occurred (involuntarily), in which the local doserate increased greatly for a short time up to distances over 1500 km. The difference between this and natural background radiation is, however, small, compared with the difference betweeen this natural background radiation and radiation emitted from nuclear power stations. From this way of considering the situation, one can draw the conclusion that there is no causal connection between damage to forests and the emission of radioactive material from nuclear power stations.

24440 (BULBW—1, pp 21-30) **Exposure of trees to radiation due to the Chernobyl accident.** Koenig, L.A.; Fessler, H. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Hauptabteilung Sicherheit). 1987. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752227/JAW. (CONF-8611224—).

From Forum on impact of radioactive materials on the atmospheric pollutant inventory and on the radioactivity uptake by plants; Stuttgart, F.R. Germany (7 Nov 1986).

Due to the reactor accident at Chernobyl, the contribution to the exposure to radiation due to radionuclides on or in the trees was considerably increased. The increase in the proportion of Cs 137 of the radioactivity contained in the leaves or needles can exceed the factor 100, compared with the time before the accident. However, the total radiation exposure remains in the range of variation of natural exposure to radiation so that radiation damage to trees in the area of West Germany cannot be shown. The increase in artificial radioactivity related to the area of West Germany is large compared with the contribution from nuclear establishments.

24441 **(BULBW—1) Forum on impact of radioactive materials on the atmospheric pollutant inventory and on the radioactivity uptake by plants. Papers and discussions.** (Beirat Umweltforschung des Landes Baden-Wuerttemberg (BULBW), Karlsruhe (Germany, F.R.)). 1987. 122p. (In German). (CONF-8611224—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752227/JAW.

From Forum on impact of radioactive materials on the atmospheric pollutant inventory and on the radioactivity uptake by plants; Stuttgart, F.R. Germany (7 Nov 1986).

This report contains 6 separately documented lectures about the following topics of the meeting: 1) Radiation exposure of plants caused by the reactor accident of Chernobyl; 2) Tritium and radiocarbon concentrations in trees; 3) Energetics of the atmospheric trace materials cycle; 4) Phenomenology of formation and decomposition of ozone in the lower atmosphere, and 5) Comparison of radioactivity levels and trace materials in the air.

24442 **(CONF-880464—1) Use of probabilistic risk assessment (PRA) in expert systems to advise nuclear plant operators and managers.** Uhrig, R.E. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02. Order Number DE88005437/JAW.

From Applications of artificial intelligence conference; Orlando, FL, USA (4 Apr 1988).

The use of expert systems in nuclear power plants to provide advice to managers, supervisors and/or operators is a concept that is rapidly gaining acceptance. Generally, expert systems rely on the expertise of human experts or knowledge that has been modified in publications, books, or regulations to provide advice under a wide variety of conditions. In this work, a probabilistic risk assessment $(PRA)^3$ of a nuclear power plant performed previously is used to assess the safety status of nuclear power plants and to make recommendations to the plant personnel. 5 refs., 1 fig., 2 tabs.

24443 **(DOE/OR/00033—T397) Analysis of deficiencies in fast reactor blanket physics predictions.** Hill, R.N. (Oak Ridge Associated Universities, Inc., TN (USA)). Dec 1987. Contract AC05-76OR00033. 200p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88006511/JAW.

This analysis addresses a deviation between experimental measurements and fast reactor blanket physics predictions. A review of worldwide results reveals that reaction rates in the blanket are underpredicted with the discrepancy increasing with penetration into the blanket. The analysis of this discrepancy involves two parts: quantifying possible error reductions using the most advanced methods and investigating deficiencies in current methodology. The source of these discrepancies was investigated by application of "state-of-the-art" group constant generation and flux prediction methodology to flux calculations for the Purdue University Fast Breeder Blanket Facility (FBBF). Refined group constant generation methods yielded a significant reduction in the blanket deviations; however, only about half of the discrepancy can be accounted for in this manner. Transport theory calculations were used to predict the blanket neutron transmission problem. The surprising result is that transport theory predictions utilizing diffusion theory group constants did not improve the blanket results. Transport theory predictions exhibited blanket underpredictions similar to the diffusion theory results. The residual blanket discrepancies not explained using advanced methods require a refinement of the theory. For this purpose an analysis of deficiencies in current methodology was performed.

24444 **(EGG-M—21787) Technical safety issues related to residual life assessment of major LWR [light water reactor] components and structures.** Shah, V.N.; MacDonald, P.E.; Burns, J.J. Jr. (EG and G Idaho, Inc., Idaho Falls (USA); Nuclear Regulatory Commission, Rockville, MD (USA)). 1987. Contract AC07-76ID01570. 21p. (CONF-8710289—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006770/JAW.

From Water reactor safety information meeting; Washington, DC, USA (26 Oct 1987).

This paper presents an assessment of the time-dependent degradation or aging of selected major light water reactor components and structures. The stressors, possible degradation sites and mechanisms are identified for several major LWR components: pressurized water reactor (PWR) reactor pressure vessels, PWR containment structures, PWR coolant piping and safe ends, PWR surge and spray lines, PWR steam generators, PWR pressurizers, PWR reactor coolant pumps, PWR control rod drive mechanisms, PWR reactor internals, LWR reactor pressure vessel supports, Boiling Water Reactor (BWR) containments, BWR reactor pressure vessels, and BWR recirculation piping. The technical safety issues related to aging and license renewal of these components are also discussed. The general concept of residual life assessment procedures for the major components is presented. 14 refs., 1 fig., 2 tabs.

24445 **(EGG-M—21887) Analysis of fission product release behavior during the TMI-2 accident.** Petti, D.A.; Adams, J.P.; Anderson, J.L.; Hobbins, R.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 40p. (CONF-8710111—40). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006744/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

An analysis of fission product release during the Three Mile Island Unit 2 (TMI-2) accident has been initiated to provide an understanding of fission product behavior that is consistent with both the best estimate accident scenario and fission product results from the ongoing sample acquisition and examination efforts. "First principles" fission product release models are used to describe release from intact, disrupted, and molten fuel. Conclusions relating to fission product release, transport, and chemical form are drawn. 35 refs., 12 figs., 7 tabs.

24446 **(EGG-M—22387) TMI-2 core bore examination results.** Olsen, C.S.; Akers, D.W.; McCardell, R.K. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 25p. (CONF-8710111—39). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006742/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Examinations are being performed on samples obtained from the lower portion of the TMI-2 reactor core as part of the TMI-2 Sample Acquisition and Examination Program. This paper presents preliminary results of visual examinations, the gamma spectrometry analyses performed on the intact core bores, and the metallurgical examinations. These examinations indicate significant core damage effects on the distribution of core materials and fission products in the lower reactor core including the substantial relocation and segregation of some fission products (e.g., Sb-125 and Ru-106). 5 refs., 14 figs.

24447 **(EGG-M—25287) Performance of a piping system and equipment in the HDR [Heissdampfreaktor] simulated seismic experiments.** Steele, R. Jr.; Arendts, J.G.; Weidenhamer, G.H. (EG and G Idaho, Inc., Idaho Falls (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1987. Contract AC07-76ID01570. 25p. (CONF-8710111—37). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006754/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

This paper describes a portion of the analysis and results of the SHAG (Shakergebaeude) Seismic Research Program conducted by Kernforschungszentrum Karlsruhe (KFK) at the Heissdampfreaktor (HDR), a decommissioned nuclear reactor. The objective of this activity was to analyze the responses of a piping system and associated line-mounted equipment when subjected to various seismic and hydraulic loadings. The studies compare the influence that piping support system flexibility has on piping system responses. The results of the studies will contribute to the technical basis for assessing the responses of light water reactor (LWR) piping and line-mounted equipment to earthquakes. 3 refs., 18 figs., 2 tabs.

24448 **(EGG-M—39386) Release and deposition of volatile fission products during in-pile severe fuel damage tests.** Vinjamuri, K.; Osetek, D.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 4p. (CONF-870601—23). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006718/JAW.

From Annual meeting of the American Nuclear Society; Dallas, TX, USA (7 Jun 1987).

Four in-pile Severe Fuel Damage (SFD) tests have been conducted in the Power Burst Facility (PBF) at the Idaho National Engineering Laboratory (INEL). These tests are part of the Severe Fuel Damage Source Term Research Program sponsored by the United States Nuclear Regulatory Commission and its international partners. The overall objectives of the SFD tests are to obtain the data necessary to understand fuel behavior, fission product behavior, and hydrogen generation during severe accidents.

24449 **(EGG-SSRE—7906) Extension and assessment of the cladding ballooning model in the FRAP-T6 code.** El-Adham, K. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1987. Contract AC07-76ID01570. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006787/JAW.

The FRAP-T6 code was extended to calculate: (1) fuel surface azimuthal temperature distribution; (2) work done on cladding by internal pressure; and (3) azimuthal heat conduction in the cladding. The extensions were assessed by comparing calculated and measured cladding ballooning characteristics for four in-pile fuel rod tests. The assessment showed that the calculation of the fuel surface azimuthal temperature distribution improved the calculations of cladding ballooning. Both calculations and experimental results indicate that coplanar blockage due to cladding ballooning is unlikely during a large break LOCA.

24450 **(EGG-TMI—7955) Analysis of the TMI-2 source range monitor during the TMI [Three Mile Island] accident.** Wu, Horng-Yu; Baratta, A.J.; Hsiao, Ming-Yuan; Bandini, B.R. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering). Jun 1987. Contract AC07-76ID01570. 125p. NTIS, PC A06. Order Number DE88006793/JAW.

The source range monitor (SRM) data recorded during the first 4 hours of the Three Mile Island Unit No. 2 (TMI-2) accident following reactor shutdown were analyzed. An effort to simulate the actual SRM response was made by performing a series of neutron transport calculations. Primary emphasis was placed on simulating the changes in SRM response to various system events

during the accident, so as to obtain useful information about core conditions at the various stages. Based on the known end-state reactor conditions, the major system events, and the acutal SRM readings, self-consistent estimates were made of core liquid level, void fraction in the coolant, and locations of core materials. This analysis expands the possible interpretation of the SRM data relative to core damage progression. The results appear to be consistent with other studies of the TMI-2 Accident Evaluation Program, and provide information useful for the developemnt and determination of the TMI-2 accident scenario.

24451 **(EGG-TMI—7956) The TMI-2 core relocation: Heat transfer and mechanism.** Epstein, M.; Fauske, H.K. (Fauske and Associates, Inc., Burr Ridge, IL (USA)). Jul 1987. Contract AC07-76ID01570. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006794/JAW.

It is postulated that the collapse of the upper debris bed was the main cause of core failure and core material relocation during the TMI-2 accident. It is shown that this mechanism of core relocation can account for the timescale(s) and energy transfer rate inferred from plant instrumentation. Additional analysis suggests that the water in the lower half of the reactor vessel was subcooled at the onset of relocation, as subcooling serves to explain the final coolable configuration at the bottom of the TMI vessel.

24452 **(EGG-WM—7264) Functional and operational design requirements for decontamination and decommissioning of the EBR-I Mark-II NaK: Final report.** Brown, B.W.; Crandall, D.L.; Dafoe, R.E.; Dolenc, M.R.; LaRue, D.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1987. Contract AC07-76ID01570. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88005632/JAW.

Approximately 180 gal of sodium/potassium (NaK) eutectic liquid metal were severely radioactively contaminated during a meltdown of the Mark-II core of the Experimental Breeder Reactor-I (EBR-I) in November 1955. This contaminated NaK, which is contained in four vessels, is currently stored in an underground bunker located at the Army Reentry Vehicle Facility Site (ARVFS) located approximately at the center of the Idaho National Engineering Laboratory (INEL). This document presents the Functional and Operational Requirements (F and ORs) for the D and D of the contaminated NaK and the ARVFS bunker site. This project will chemically deactivate the NaK; dispose of the radioactively contaminated product at a designated burial site; chemically deactivate any residual NaK in the containers, and dispose of the containers at a designated burial site; decontaminate and decommission any contaminated process equipment used in these operations, and decontaminate and decommission the ARVFS bunker site. Completion of the above technical objectives will allow for the effective disposition of the NaK, and will return the ARFVS bunker and immediate area to a reusable condition. Upon completion, the ARVFS NaK, which is now considered a significant potential hazard, will be removed from the Surplus Facilities Management Program priority listing of projects. 33 refs., 8 figs.

24453 **(EPRI-NP—5641-SR) Proceedings: 1986 integrated power plant computer communications seminar.** Halter, M.; Colley, R.; Divakaruni, S.M. (Pacific Gas and Electric Co., San Francisco, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Feb 1988. 472p. (CONF-8608110—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920217/JAW.

From Seminar on integrated power plant computer communications; San Francisco, CA, USA (25 Aug 1986).

An EPRI workshop to address integrated power plant computer communications was hosted by Pacific Gas and Electric Company in San Francisco, California, on August 25 to 27, 1986. The participants represented a broad spectrum of US and foreign utilities, archiect engineering firms, computer equipment vendors, software companies, and engineering consultants. These proceedings contain the text of the formal presentations. The formal presentations were organized in the following five technical sessions: Computer Communications Technology; Computer Communications Technology and Standards; Ongoing Communication Projects; Communication Projects in the Utility Industry; Planning and Implementation. In addition to the formal presentations, a detailed questionnaire was distributed to the attendees to solicit ideas on the issues related to technology transfer to the US utilities and to determine the research and development needs in the communications areas. Individual papers are indexed separately.

24454 **(GRS—65) Recommendations of the RSK 1984-1986. Vol. 6.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Oct 1987. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752645/JAW.

After publication of the recommendations in the Bundesanzeiger, the office of the RSK publishes them once more as a summary report by order of the Federal Minister for the Environment, Nature Conservation and Nuclear Safety. The report is divided generally into two parts: Part 1 contains the recommendations which are given by the RSK; part 2 contains the official notices concerning the RSK. There is also a subject index.

24455 **(INIS-GB—59) Disaster cocktail. (Chernobyl Special).** (International Atomic Energy Agency, Vienna (Austria)). Sep 1986. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780019/JAW.

Power News is the Staff newspaper of the Central Electricity Generating Board. This issue was produced to let CEGB staff and others know about the causes and consequences of the accident at the Chernobyl 4 reactor on April 26 1986. The information is taken from the reports provided by the Russian scientists to the Vienna conference organised by the International Atomic Energy Agency. Emphasis is placed on the design weaknesses and operator errors. These were such that a similar accident could not happen in a British reactor. A detailed timetable of the accident is given. The Russian response to the accident is described as "fast and efficient". (UK)

24456 **(INIS-mf—11624) Radiological consequences of Chernobyl.** Kaul, A. (Kerntechnische Gesellschaft e.V., Bonn (Germany, F.R.); Deutsches Atomforum e.V., Bonn (Germany, F.R.); Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). 1987. 10p. (In German). (CONF-870602—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752245/JAW.

From Annual meeting on nuclear technology; Karlsruhe, F.R. Germany (2 Jun 1987).

The deposition of 1% oder 3% of the radioactivity of I 131 or Cs 134 and Cs 137 emitted from the reactor core in West Germany corresponds to masses of 1 g or 400 g respectively. The southern part of Germany was particularly affected by fallout. The article gives the consequences for soil radiation, for air near the soil, drinking water and foodstuffs. The radiation exposure based on the measured concentration of radioactivity and the possible cancer risk from radiation are estimated.

24457 **(JAERI-M—87-135) Pipe rupture test result: cross-over leg pipe whip test under PWR LOCA conditions (RUN 5808, 5809).** Kurihara, Ryoichi; Ueda, Shuzo; Isozaki, Toshikuni; Kato, Rokuro; Kato, Kiyoshi; Miyazono, Shohachiro. (Japan Atomic Energy Research Inst., Tokyo). Sep 1987. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752309/JAW.

A series of pipe rupture tests has been performed at the Japan Atomic Energy Research Institute (JAERI) to demonstrate the safety of the primary coolant circuits in the event of pipe rupture, in nuclear power plants. The present report summarizes the results of cross-over leg pipe whip tests (RUNs 5808, 5809), under PWR LOCA conditions (325 deg C, 15.7 MPa), which were performed in April, 1984. The cross-over leg pipe whip test was performed to demonstrate the integrity of the restraints at the LOCA by using a 1/6 model of piping in the PWR nuclear power plants. Strain-gages, accelerometers and load cells were used to measure the dynamic response of the test pipe. Test results showed that the deformation of the restraints were within elastic region, and the residual deformation at the free end of pipe was within 10 mm.

24458 **(JAERI-M—87-158) Carbon deposition phenomena in HENDEL.** Okuyama, Kunito; Yokota, Syuuichi. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 46p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752318/JAW.

In a high-temperature, helium gas-cooled, graphite-moderated reactor(HTGR), significantly high levels of gaseous impurities could lead to the occurrence of the carbon transport phenomena, where the impurity species water or carbon dioxide react with graphite in the core, producing carbon monoxide and hydrogen, which in turn react at the metal surfaces to form carbon deposits. Carbon deposition occurred on the inner surface of the pressure vessel and the outer surface of the inner vessel of the HENDEL T/sub 2/ test section, which has a large amount of graphite (50 ton). From X-ray analysis, it was found that the deposited carbon is not the graphite but amorphous, therefore, produced by chemical reaction. The levels of hydrogen and carbon monoxide in helium gas which are the sources of the carbon deposition remarkably increased just after increasing the temperature of helium gas flowing into the graphite from 700 deg C to 930 deg C. Such increase of the impurities can be regarded as the result of the reaction of graphite with water absorbed in the atmosphere and outgassing the products from the graphite. It has been shown that the effective method to limit the carbon deposition is the helium gas purification taking account of the impurity concentration ratios, H/sub 2//H/sub 2/O and/or CO/CO/sub 2/ based on the thermodynamic equilibrium.

24459 **(JAERI-M—87-163) Predictability of REFLA core model for SCTF data.** Iguchi, Tadashi; Murao, Yoshio. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 117p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752314/JAW.

Predictability of REFLA code with "local power profile model" was investigated for SCTF tests results. The code gives a systematic error on the prediction of the quench front advancement, but it gives a fairly good prediction on the relationship between the heat transfer coefficient and the distance from the quench front. Accordingly, the heat transfer coefficient transient will be predicted well by improving the prediction on the quench front movement. In order to study the reason for the error on the prediction of the quench front advancement, the sensitivities of the inputted boundary conditions on the calculations was investigated. The investigation showed that the inputted boundary conditions except for the core flow area and the core flooding rate were weak in affecting the calculations. It is necessary to study further for concluding the unique or exact reason for the error. The present version of REFLA code gave a prediction for the data of SCTF with a full-radius core, in the same order of accuracy as for the CCTF data.

24460 **(JAERI-M—87-179) Fixation of fission product iodine in drain water in reactor containment under severe core damage accident condition as silver iodide.** Ishiwatari, Nasumi; Nagai, Hitoshi. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 25p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752319/JAW.

In the source term evaluation for severe core damage accident of light water reactor, the uncertainty on the evaluation by the occurrence of volatile iodic compounds is reduced by large margine by using the method of fixation of FP iodine as silver iodide. In the aqueous solution at radiation field, the iodide(I/sup -/) is oxidized to the iodine(I/sub 2/) which can form the organic iodide, by reacting to the decomposition products of water by radiolysis. The iodide ion caused by FP iodine transfered from reactor coolant system into drain water in reactor containment at SCD accident can be fixed as silver iodide by addition of soluble silver salt before the occurrence of volatile iodic compounds. Under the experimental condition in the cobalt-60 gamma ray irradiation of 10/sup 5/ ~ 10/sup 6/ R/hr in dose rate, the phenomenon as described below were confirmed; (i) the silver iodide retained its original form, (ii) the iodine(I/sub 2/) and the iodide(I/sup -/) were produced from dissolving of the methyl iodide, and (iii) in the aqueous solution which the iodide(I/sup -/) and the organic compounds coexisted, the methyl iodide was synthesized.

24461 **(KFK—4328) Approximative determination of failure probabilities for crack containing components.** Riesch-Oppermann, H. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Zuverlaessigkeit und Schadenskunde im Maschinenbau). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Zuverlaessigkeit und Schadenskunde im Maschinenbau). Nov 1987. 58p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752676/JAW.

Two examples from nuclear engineering (leak-before-break behavior of pressurized components, PWR containment) are used to demonstrate the accuracy of the approximate determination of failure probabilities for crack containing components using First-Order-Reliability Methods (FORM). The fracture mechanical models and the results of calculations using FORM and Monte-Carlo methods are reported. Modified (Second-Order) methods are used to improve the accuracy of the results. It is possible to estimate the influence of correlations between the basic variables using a slightly modified version of FORM. This is demonstrated with the same examples.

24462 **(NUREG—1236) Thermal-hydraulic research plan for Babcock and Wilcox plants.** Lee, R.Y. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems). Feb 1988. 43p. NTIS, PC A03/MF A01 - GPO. Order Number TI88900461/JAW.

This document presents a plan for thermal-hydraulic research for Babcock and Wilcox designed reactor systems. It describes the technical issues, regulatory needs, and the research necessary to address these needs. The plan also discusses the relationship between current and proposed research, and provides a tentative schedule to complete the required work.

24463 **(NUREG/CP—0091-Vol.1) Proceedings of the US Nuclear Regulatory Commission fifteenth water reactor safety information meeting: Volume 1, Plenary sessions, reactor licensing topics, NUREG-1150, risk analysis/PRA applications, innovative concepts for increased safety of advanced power reactors, severe accident modeling and analysis.** Weiss, A.J. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Feb 1988. Contract AC02-76CH00016. 475p. (CONF-8710111—Vol.1). NTIS, PC A20/MF A01 - GPO. Order Number TI88006850/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

This six-volume report contains 140 papers out of the 164 that were presented at the Fifteenth Water Reactor Safety Information Meeting held at the National Bureau of Standards, Gaithersburg, Maryland, during the week of October 26-29, 1987. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. This report, Volume 1, discusses the following: plenary sessions; reactor licensing; NUREG-1150; risk analysis; innovative concepts for increased safety of advanced power reactors; and severe accident modeling and analysis. Thirty-two reports have been cataloged separately.

24464 **(NUREG/CP—0091-Vol.2) Proceedings of the US Nuclear Regulatory Commission fifteenth water reactor safety information meeting: Volume 2.** Weiss, A.J. (comp.). (Brookhaven National Lab., Upton, NY (USA)). Feb 1988. Contract AC02-76CH00016. 463p. (CONF-8710111—Vol.2). NTIS, PC A20/MF A01 - GPO. Order Number TI88006107/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

This six-volume report contains 140 papers out of the 164 that were presented at the Fifteenth Water Reactor Safety Information Meeting held at the National Bureau of Standards, Gaithersburg, Maryland, during the week of October 26-29, 1987. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety re-

search conducted in this country and abroad. Foreign participation in the meeting included twenty-two different papers presented by researchers from Belgium, Czechoslovakia, Germany, Italy, Japan, Russia, Spain, Sweden, The Netherlands and the United Kingdom. The titles of the papers and the names of the authors have been updated and may differ from those that appeared in the final program of the meeting. This report, volume 2 discusses Materials Engineering/Pressure Vessel Research and Radiation and Degraded Piping Effects; Non-destructive Evaluations; and Environmental Effects in Primary Systems. Twenty-three papers have been cataloged separately.

24465 **(NUREG/CP—0091-Vol.3) Proceedings of the US Nuclear Regulatory Commission fifteenth water reactor safety information meeting: Volume 3.** Weiss, A.J. (comp.). (Brookhaven National Lab., Upton, NY (USA)). Feb 1988. Contract AC02-76CH00016. 413p. (CONF-8710111—Vol.3). NTIS, PC A18 - GPO. Order Number TI88006305/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

This six-volume report contains 140 papers out of the 164 that were presented at the Fifteenth Water Reactor Safety Information Meeting held at the National Bureau of Standards, Gaithersburg, Maryland, during the week of October 26-29, 1987. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. Foreign participation in the meeting included twenty-two different papers presented by researchers from Belgium, Czechoslovakia, Germany, Italy, Japan, Russia, Spain, Sweden, The Netherlands and the United Kingdom. The titles of the papers and the names of the authors have been updated and may differ from those that appeared in the final program of the meeting. This report, Volume 3, discusses Aging and Life Extension; Structural and Seismic Research; and Mechanical Research. Twenty-two reports have been cataloged separately.

24466 **(NUREG/CP—0091-Vol.5) Proceedings of the US Nuclear Regulatory Commission fifteenth water reactor safety information meeting: Volume 5, Industry safety research, International Code Assessment Program.** Weiss, A.J. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Feb 1988. Contract AC02-76CH00016. 469p. (CONF-8710111—Vol.5). NTIS, PC A20/MF A01. Order Number TI88006492/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

This six-volume report contains 140 papers out of the 164 that were presented at the Fifteenth Water Reactor Safety Information Meeting held at the National Bureau of Standards, Gaithersburg, Maryland, during the week of October 26-29, 1987. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. This report, volume 5, discusses Industry Safety Research and the International Code Assessment Program. Twenty reports have been cataloged separately.

24467 **(NUREG/CP—0091-Vol.6) Proceedings of the US Nuclear Regulatory Commission fifteenth water reactor safety information meeting: Volume 6, Decontamination and decommissioning, accident management, TMI-2.** Weiss, A.J. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Feb 1988. Contract AC02-76CH00016. 256p. (CONF-8710111—Vol.6). NTIS, PC A12 - GPO. Order Number TI88006636/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

This six-volume report contains 140 papers out of the 164 that were presented at the Fifteenth Water Reactor Safety Information Meeting held at the National Bureau of Standards, Gaithersburg, Maryland, during the week of October 26-29, 1987. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. This report, Volume 6, discusses decontamination and decommissioning, accident management, and the Three Mile Island-2 reactor accident. Thirteen reports have been cataloged separately.

24468 **(NUREG/CR—4996) A report on the Round Robin Program conducted to evaluate the proposed ASTM standard test method for determining the plane strain crack arrest fracture toughness, K/sub Ia/, of ferritic materials.** Barker, D.B.; Chona, R.; Fourney, W.L.; Irwin, G.R. (Maryland Univ., College Park (USA)). Jan 1988. Contract AC05-84OR21400. 192p. (ORNL/Sub—79-7778/4). NTIS, PC A09/MF A01 - GPO. Order Number TI88004205/JAW.

This report summarizes the results from a Round Robin Program that was conducted during 1983-1985 to evaluate a proposed ASTM Test Method for Crack Arrest Fracture Toughness of Ferritic Materials. The Round Robin attracted a total of twenty-seven participants from the United States, Canada, Europe and Japan, each of whom agreed to test three specimens of A514 bridge steel, three specimens of A588 bridge steel, and six specimens of A533 Grade B Class 1 reactor pressure vessel steel. Twenty-one participants completed their testing and forwarded test results for inclusion and discussion in this report. Modifications to the proposed test method that are called for in the light of the experience gained from the Round Robin are also discussed. The test method has been revised and is currently in the process of being considered by ASTM Committee E-24 on Fracture Testing as a Proposed Standard Test Method. 20 refs., 44 figs., 6 tabs.

24469 **(NUREG/CR—5070) Analysis of natural-convection phenomena in a 3-loop PWR during a TMLB' transient using the COMMIX code.** Domanus, H.M.; Sha, W.T. (Argonne National Lab., IL (USA)). Jan 1988. Contract W-31109-ENG-38. 52p. (ANL—87-54). NTIS, PC A04/MF A01 - GPO. Order Number TI88006637/JAW.

A numerical simulation of the multidimensional thermal-hydraulic characteristics in a 3-loop PWR during a hypothetical TMLB' accident scenario has been performed by means of the COMMIX computer code. The operating conditions, as well as the modeling approaches used in the simulation, are discussed. Selected results, which show the natural circulation phenomena and compare the thermal-hydraulic behavior in the different loops, are presented.

24470 **(PNL-SA—13871) Use of radiological accident experience in establishing appropriate perspectives in emergency planning.** Selby, J.M.; Vallario, E.J.; Moeller, D.W.; Stephan, J.G. (Pacific Northwest Lab., Richland, WA (USA); USDOE, Washington, DC; Harvard Univ., Boston, MA (USA)). Aug 1987. Contract AC06-76RL01830. 20p. (CONF-8609147—14). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005688/JAW.

From American Nuclear Society annual meeting; Bethesda, MD, USA (15 Sep 1986).

Within a nuclear facility, an emergency can range from a situation that only involves the employees of that facility to a series of events that have both onsite and offsite consequences. Analyses of nuclear and non-nuclear emergencies can provide valuable information on the causes of, as well as the problems encountered during emergencies. Reports on facility emergencies indicate that up to 90% involve human error. Such events occur more frequently during the night shifts or on weekends. These occurrences may result from the absence of experienced personnel as well as the reduced alertness of onsite personnel. Therefore, this paper emphasizes the human element in a review of accidents that have occurred at nuclear facilities including Windscale, SL-1, the Recuplex criticality, the Wood River Junction criticality, the Browns Ferry fire, Three Mile Island, and Chernobyl. These accidents are described, and their consequences are evaluated. The information obtained from these evaluations may be useful for inclusion in nuclear plant operating and testing procedures. 21 refs.

24471 **(SCSIN-REP—1-2-A-80) Hazard related to aircraft crashes.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Aug 1980. 6p. (SIN-Z—3253-80). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752206/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The present rule sets forth the requirements governing the safety analysis of PWR with special reference to air traffic hazards.

24472 **(SCSIN-REP—1-2-B-80) Risks of emission of missiles following bursting of turbogenerator sets.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Aug 1980. 7p. (SIN-Z—3254-80). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752207/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The present rule sets forth the requirements governing the analysis of risks caused by missiles emitted following bursting of turbogenerator sets.

24473 **(SCSIN-REP—1-2-C-81) Calculation of seismic motions to be considered in safety analysis.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Oct 1981. 19p. (SIN-B—5149-81). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752210/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The aim of this RFS is to define an acceptable method for calculating seismic motions to be considered in the seismic design of the facility.

24474 **(SCSIN-REP—1-2-D-82) Evaluation of potential hazards presented by the nearby industrial environment and transportation routes.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). May 1982. 28p. (SIN-Z—2175-82). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752209/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The purpose of this RFS is to define methods for determining risks created by potential hazards represented by the industrial environment and transportation routes in the vicinity of a PWR, in order to verify design criteria acceptability with regard to such hazards.

24475 **(SCSIN-REP—1-2-E-84) Hazards related to external flooding.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Apr 1984. 16p. (SIN—2058-84). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752211/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. This RFS is intended to give state-of-the-art definitions of: - an acceptable method to determine water levels to be used in flood design of a facility - facility design principles required to meet the principles above.

24476 **(SCSIN-REP—1-3-A-80) Application of the single failure criterion in safety analysis.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Aug 1980. 11p. (SIN-Z—3252-80). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752212/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts

and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The present rules define the single failure criterion used among other elements in the safety analysis of the main safety-related systems of PWR.

24477 (SCSIN-REP—1-3-B-84) Seismic instrumentation. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Jun 1984. 13p. (SIN-Z—3076-84). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752198/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The aim of this RFS is to define the type, location and operating conditions for seismic instrumentation needed to determine promptly the seismic response of nuclear power plants features important to safety to permit comparison of such response with that used as the design basis.

24478 (SCSIN-REP—1-3-C-85) Site geological and geotechnical studies, determination of soil characteristics and soil response studies. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Aug 1985. 10p. (SIN—3564-85). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752199/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The purpose of this RFS is to specify the soil characteristics to be determined and the soil response studies to be performed as part of site geological and geotechnical studies.

24479 (SCSIN-REP—4-1-A-84) Classification of mechanical components electrical systems and civil works structures. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Dec 1984. 23p. (SIN—7247-84). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752200/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The purpose of this RFS is to define the various classifications used in French regulatory practice with regard to safety.

24480 (SCSIN-REP—4-2-A-84) Requirements to be taken into account when designing safety-related mechanical components conveying or containing pressurized fluid and classified as level 2 or 3. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Dec 1984. 18p. (SIN—7243-84). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752201/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The purpose of this RFS is to specify the requirements to be taken into account when designing mechanical components conveying or containing pressurized fluid and which are in safety class 2 or 3.

24481 (SCSIN-REP—4-2-B-85) Requirements to be taken into account in the design, qualification startup and operation of electrical equipment for safety-related electrical systems. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Jul 1985. 12p. (SIN—3557-85). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752202/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The purpose of this RFS is to provide the rules to be respected in order that safety-related electrical systems can perform its function under plausible operating conditions.

24482 **(SCSIN-REP—5-1-A-82) Determination of radioactivity released from fuel to be considered in accident safety analysis.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Jan 1980. 11p. (SIN—245-82). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752203/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The purpose of this RFS is to define a margin of conservatism on activity values used in the following safety analysis - determination of instrumentation ranges - definition of equipment accessibility to personnel - qualification of equipment to post-accident conditions - determination of waste release to the environment.

24483 **(SCSIN-REP—5-2-A-81) Nuclear power plant units equipped with a pressurized-water reactor.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Nov 1981. 27p. (SIN-Z—5613-81). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752204/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The aim of this rule is to define a series of measures to meet these general regulatory equipments. By applying this rule, the quality assurance code of practice for nuclear power plant safety, established by the International Atomic Energy Agency (I.A.E.A.), is considered to be observed.

24484 **(SCSIN-REP—5-2-B-81) General rules applicable to civil works.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Jul 1981. 9p. (SIN-Z—4146-81). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752193/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. For civil works, the use of the RCC. G (Design and Construction Rules for Civil works of 900 MWe PWR Nuclear Power Plants) is accepted with conditions described in this RFS.

24485 **(SCSIN-REP—5-2-F-82) Nuclear power plant units equipped with a pressurized water reactor.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Dec 1982. 10p. (SIN—E-6230-82). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752176/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. For fire protection, the use of the RCC-I (Design and Construction Rules for Fire Protection in PWR Nuclear Islands) is accepted with conditions described in this RFS.

24486 **(SCSIN-REP—5-2-G-85) Civil Works Seismic Designs.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Dec 1985. 19p. (SIN—5036-85). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752177/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. This rule defines: - the parameters characterizing the design seismic motions - the calculation methods - the mathematical schematization principles on which calculations are based - the use of the seismic response for the structure checking - the content of the documents to be presented.

24487 **(SCSIN-REP—5-2-H-86) General Rules applicable to the civil works construction.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Jun 1986. 7p. (SIN—1557-86). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752178/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardiza-

tion in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. For civil works construction, the use of the RCC-G (Design and Construction Rules for Civil Works of 900 MWe PWR Nuclear Power Plants) is accepted with conditions described in this RFS.

24488 **Numerical simulation of PWR response to a small-break LOCA with reactor coolant pumps operating.** Adams, J.P.; Dobbe, C.A.; Bayless, P.D.; Kim, J.H. (Idaho National Engineering Lab., EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—). Contract AC07-76ID01570.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Calculations have been made of the response of pressurized water reactor (PWRs) during a small-break loss-of-coolant accident (LOCA) with the reactor coolant pumps (RCPs) operating. An objective of this study was to assess the relationship between measurable RCP parameters, such as motor power and current, with RCS fluid void fraction during an off-nominal transient for the purpose of transient identification. The computer codes used in this study were RELAP4 and RELAP5. RELAP4 utilizes a one-dimensional, homogeneous, equilibrium (three-equation) model to describe the mass, momentum, and energy conservation of the two-phase mixture. RELAP5, a much more sophisticated code, employs a one-dimensional, two-fluid, nonhomogeneous, quasi-nonequilibrium (five-equation) model to describe two-phase flows. Both computer codes use a series of control volumes and component models, connected by junctions, to model the reference plants.

24489 **TRAC-BD1: A fast running code for BWR analysis.** Weaver, W.L.; Singer, G.L.; Rouhani, S.Z.; Shumway, R.W.; Johnsen, G.W. (Idaho National Engineering Lab., EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—). Contract AC07-76ID01570.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

The TRAC-BWR Code Development Program at the Idaho National Engineering Laboratory (INEL) is developing versions of the TRAC code for the U.S. Nuclear Regulatory Commission to provide a best estimate analysis capability for the simulation of postulated accidents and transients in BWR power systems and related experimental facilities. Since the release of TRAC-BD1/MOD1, code development at INEL has focused on improving computational efficiency and on improving computational accuracy for ATWS analysis. These efforts have resulted in the TRAC-BF1 code which was completed for release to USNRC approved recipients in June, 1986. Changes to the coding and code architecture have resulted in a code which is almost 100% ANSI standard FORTRAN 77 which has enhanced machine independence, portability, and maintainability. The major improvement to the numerical solution procedure was the implementation of a hybrid Courant-limit violating numerical integration technique which is based on the Two-Step numeric developed at the Los Alamos National Laboratory and the Predictor-Corrector method developed at the General Electric Company. Improved computational accuracy for ATWS transients was achieved by improved constitutive models and by the implementation of a one-dimensional neutron kinetics model based on the Analytic Nodal method. The paper briefly describes the hybrid Courant-limit violating numerical integration technique and present selected results of the developmental assessment test cases.

24490 **Critical flow through pipe cracks.** Schrock, V.E.; Revankar, S.T.; Lee, S.Y. (Dept. of Nuclear Engineering, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

The presence of intergranular stress corrosion cracks (IGSCC) in thermal and pressure stressed weld zones in stainless steel piping and associated components is of concern in nuclear reactor safety. The prediction of leak rates has been identified as an important developmental area for implementation of a "leak-before-break" philosophy in the regulatory process. This paper presents an analytical model that has been developed to predict the flow rate of initially saturated or subcooled liquid through cracks. It is recognized that the flow path through a crack is complex and some simple characterization is necessary for practical calculation of the flow evolution. The present model treats the crack as a convergent channel with the bends, expansions, and contraction lumped into a equivalent friction factor. A general method was developed for this from observations of photomicrographs of IGSCC. The homogeneous equilibrium model together with an empirical subcooling correction factor is the basis of a computer code called SOURCE which calculates the flow evolution and the critical flowrate for a specified crack opening, its length on the outer pipe circumference and the pipe wall thickness. SOURCE employs the steady state form of HEM equations to solve the flow evolution marching from the inlet for an assumed flowrate. The local velocity is compared with the local HEM sound speed and by iteration the mass flowrate is found that satisfied the critical flow criterion at the channel outlet. A non-uniform axial discretization is accomplished by the code to assure accuracy as the pressure gradient steepens. An efficient subroutine STEAM provides the saturated fluid properties.

24491 **TRAC-PF1/MOD1 model of improved PWR reactor ECC refilling in case of redesigned downcomer.** Popov, N.K.; Rohatgi, U.S. (Dept. of Nuclear Energy, Brookhaven National Lab., Upton, NY 11973). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

To improve the efficiency of the ECC refilling of the lower plenum, the PWR downcomer has been redesigned by means of simple constructional modification. Namely, vertical obstructions have been inserted in the downcomer annular region, which separate the downcomer annulus in as many vertical channels as there are reactor primary loops. In such design, each cold leg inlet pipe is separated from the neighbouring cold leg pipe entrances by vertical ribs extending from the top of the downcome annulus to the core bottom. During reactor normal operation, the vertical downcomer ribs do not affect the downflow of the reactor coolant. However, in the case of rupture of one cold leg pipe, the vertical ribs in the downcomer prevent the azimuthal bypass flow of the injected ECC water from the intact cold legs towards the broken cold leg pipe entrance. The ECC water is forced to flow downwards, along the downcomer ribs, filling the lower plenum, instead of being entrained by the steam and expelled through the rupture. The CREARE H1 experimental test, has been modeled with TRAC-PF1/MOD1 code in case of redesigned downcomer annulus. The obtained results clearly show the effectiveness of the downcomer ribs. A considerable improvement of the refilling rate has been obtained, with much earlier refilling initiation, compared to the experimental data. The obtained results indicate that experimental tests with redesigned downcomer are needed and justified.

24492 **A multifluid, multiphase flow and heat transfer model for the prediction of sweepout from a reactor cavity.** Sienicki, J.J.; Spencer, B.W. (Reactor Analysis and Safety Div., Argonne National Lab., 9700 South Cass Ave., Bldg. 206, Argonne, IL 60439). pp 1 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

For Light Water Reactor severe accident sequences in which it is postulated that meltthrough of the reactor pressure vessel lower head occurs at elevated primary system pressure, the flow of molten corium into the reactor cavity beneath the failed RPV will be followed by a blowdown of high pressure steam and hydrogen through the breach. The gas discharging from the breached vessel constitutes a source of driving forces capable of dispersing corium and water from the cavity through the various pathways leading to other parts of the containment building. A one-dimensional, three fluid, Eulerian, multicell, two-phase flow and heat transfer computer model has been developed to predict sweepout from a reactor cavity through a one-dimensional channel. The mass, momentum, and enthalpy equations for corium, water, and the gas phase are discussed together with the numerical solution methodology. Special emphasis is devoted to the definition of the various exchange terms especially those describing the rate of entrainment of droplets from various film layers, the size of the entrained droplets, freezing of corium upon structure, and the oxidation of corium constituents by steam. Model predictions for the corium mass swept out, corium droplet size, sweepout timescale, and the two-phase pressure drop along the dispersal pathway are shown to be in good agreement with the results of the 1:30 scale CWTI-13 reactor material dispersal experiment. The model is applied to the prediction of sweepout from the cavity and tunnel region of a full-size reactor system having dimensions of the Zion PWR plant during a TMLB' sequence.

24493 **Sampling and characterization of aerosols produced under simulated nuclear reactor accident conditions.** Schlenger, B.J.; Horton, E.L.; Herceg, J.E.; Dunn, P.F. (Engineering Div., Reactor Analysis and Safety Div., Argonne National Lab., Argonne, IL 60439). pp 1-3 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—). Contract W-31-109-ENG-38.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Four experiments have been conducted by Argonne National Laboratory in which nuclear reactor fuel elements were driven to the point of severe cladding degradation by fission heating and steam oxidation. The experimental conditions of pressure, temperature and steam flow approximated those predicted for hypothetical severe light water reactor accidents. The primary purpose of these tests was to sample and characterize that portion of the volatile fission products released from the fuel that condensed and traveled in aerosol form. The aerosol sampling system, common to the four test vehicles, was designed to capture a representative fraction of the radioactive and chemically reactive aerosol particles entrained in the high pressure (up to 8 MPa) and high temperature (approximately 650 K) gas steam. The gas was comprised of both steam and hydrogen, the hydrogen resulting from the oxidation of the fuel cladding. Aerosol particle size distributions and loadings were essentially unknown prior to the tests. Therefore, the system was designed to capture particles by a variety of mechanisms to ensure adequate sampling over a wide range of sizes, and the sampling path was relatively long to accommodate a wide range of particle loadings. Following the tests the collection devices were removed from the chambers and examined using a variety of microanalytical techniques. The elemental composition and morphology of the deposited particles were determined by scanning electron microscopy, electron microprobe analysis, secondary ion mass spectrometry and bulk analysis. Identification of selected chemical species was made by x-ray diffraction.

24494 **Development and calibration of an aerosol monitor for PBF test SFD 1-4.** Adams, J.P.; Partin, J.K.; Petti, D.A.; Reed, T.R. (Idaho National Engineering Lab., EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—). Contract AC07-76ID01570.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

An understanding of fission product behavior during a severe core damage accident in a light water reactor is needed to predict, accurately, the resultant radiological source term to the environment. An internationally sponsored series of four severe fuel damage (SFD) experiments was conducted in the Power Burst Facility at the Idaho National Engineering Laboratory to characterize fission product release and transport from a 32-rod bundle of severely damaged nuclear fuel. The last of these, SFD Test 1-4, was designed to study the interaction of fission products with aerosols generated from control rod, fuel rod cladding, and core structural materials. An on-line areosol monitor was developed and installed on the test effluent line to study the time-dependent aerosol concentration during the experiment. The aerosol monitor, consisted of two turbidity monitors corresponding to 1- and 4-cm light paths, which measured the attenuation of light caused by aerosols in the effluent stream. The outputs from these two attenuation cells were used to determine the aerosol number density.

24495 **Gas-cooled reactor for space power systems.** Walter, C.E.; Pearson, J.S. (Lawrence Livermore National Lab., Livermore, CA). pp 485-492 of Proceedings of the 22nd intersociety energy conversion engineering conference. New York, NY; American Institute Aeronaut and Astronaut (1987). (CONF-870804—). Contract W-7405-ENG-48.

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Technical Paper 879362.

Reactor characteristics based on extensive development work on the 500-MWt reactor for the Pluto nuclear ramjet are described for space power systems useful in the range of 2 to 20 MWe for operating times of 1 y. The modest pressure drop through the prismatic ceramic core is supported at the outlet end by a ceramic dome which also serves as a neutron reflector. Three core materials are considered which are useful at temperatures up to about 2000 K. Most of the calculations are based on a beryllium oxide with uranium dioxide core. Rector control is accomplished by use of a burnable poison, a variable-leakage reflector, and internal control rods. Reactivity swings of 20% are obtained with a dozen internal boron-10 rods for the size cores studied. Criticality calculations were performed using the ALICE Monte Carlo code. The inherent high-temperature capability of the reactor design removes the reactor as a limiting condition on system performance. The low fuel inventories required, particularly for beryllium oxide reactors, make space power systems based on gas-cooled near-thermal reactors a lesser safeguard risk than those based on fast reactors.

24496 **Potential radiation doses from a space nuclear reactor following reentry.** Boudreau, J.M.; Bell, C.R.; Scoggins, W.A.; Voss, S.S. (Los Alamos National Lab., Los Alamos, NM). pp 462-468 of Proceedings of the 22nd intersociety energy conversion engineering conference. New York, NY; American Institute Aeronaut and Astronaut (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Technical Paper 879295.

Los Alamos National Laboratory has assessed the potential radiation exposures that could result from the intact reentry of a 300-kWe space nuclear reactor following operation. Although the reentry of such reactors is not being planned, this analysis investi-

gated the consequences should such an event occur. The SANDIA-ORIGEN computer code was used to calculate the buildup and decay of the radiological inventory for various reactor operating times. MCNP, a Monte Carlo computer code, was used to calculate external whole-body dose rates as a function of distance from a shielded and unshielded reactor core. It was found that the whole-body dose rate from an unshielded, intact core is approximately 190 mrem/h at 1 m following 7 yr of operation and 300 yr of decay. Although this dose rate is not large, there is a notable benefit to be derived from shielding the core with soil or water as a result of the reactor penetrating the Earth's surface on impact. Thus, the potential radiation exposures from space reactors can be minimized by preventing near-term reentry and designing for intact reentry and effective burial should reentry occur.

24497 **Space nuclear power systems, 1986: Volume 5.** El-Genk, M.S.; Hoover, M.D. (eds.). Malabar, FL; ORBIT Book Company, Inc. (1987). 466p. (CONF-860102—). ORBIT Book Company, Inc., 2005 Township Rd., Malabar, FL 32950. Order Number TI88006166/JAW. Contract AC04-76DP00789;W-7405-ENG-36.

From 3. symposium on space nuclear power systems; Albuquerque, NM, USA (13 Jan 1986).

This volume contains the peer reviewed and edited versions of many of the papers presented at the 3rd Symposium on Space Nuclear Power Systems held in Albuquerque, New Mexico, January 13-16, 1986. It is the fifth volume in the series Space Nuclear Power Systems. The objective of the symposia, and hence this volume, is to summarize the state of knowledge in the area of space nuclear power systems and to provide a forum at which the most recent findings and important new developments can be presented. Space Nuclear Power Systems 1986 includes a total of 45 papers prepared by 119 authors from more than 30 organizations. These 45 papers have been cataloged separately.

24498 **Study of the hovering period and bubble size in fully developed pool nucleate boiling of saturated liquid with a time-dependent heat source.** Pasamehmetoglu, K.O.; Nelson, R.A.; Gunnerson, F.S. (Nuclear Technology and Engineering Div., Los Alamos National Lab., Los Alamos, NM (USA)). pp 39-46 of Nonequilibrium transport phenomena. Dobran, F.; Bankoff, S.G.; Chen, J.C.; El-Genk, M.S. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870816—).

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

In this paper, the bubble behavior in saturated pool boiling with a time-dependent heat source is analyzed. The study is restricted to the period from fully developed nucleate boiling until critical heat flux occurs. The hovering period and the departure volume of the bubble are selected as the characteristic parameters for bubble behavior. These parameters are quantified by solving the equation of motion for an idealized bubble. This equation is solved for cases in which the surface heat flux changes linearly and exponentially as a function of time. After nondimensionalization, the results are compared directly with the results of the steady-state problem. The comparison shows that the transient heat input has practically no effect on the hovering period. However, the transient heat flux causes a decreased volume at bubble departure. The volume decrease is dependent on the severity of the transient. These results are in qualitative agreement with the experimental observation quoted in the literature.

24499 **Analysis of transient contacting in the low temperature film boiling regime. Part II: Comparison with experiment.** Farmer, M.T.; Jones, B.G.; Spencer, R.W. (Dept. of Nuclear Engineering, Univ. of Illinois at Urbana-Champaign, Urbana, IL (USA)). pp 31-38 of Nonequilibrium transport phenomena. Dobran, F.; Bankoff, S.G.; Chen, J.C.; El-Genk, M.S. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870816—).

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

After adjustment of empirical constants contained within the model of the transient contacting process developed in Part I of this paper, predictions of the duration of transient contact, frequency of contact, local liquid-contact-time fraction, and local liquid-contact-area fraction show good agreement with experimental results for a copper/water system reported in the literature. Extension of the model indicates that for surfaces with poor thermal properties, heat transfer due to transient contact can constitute a major portion of the total heat transfer in the film boiling regime. A comparison of the minimum film boiling condition, developed on the basis of a surface thermal recovery time, shows reasonable agreement with Henry's correlation and also with experimental data reported in the literature for copper and stainless steel surfaces.

24500 **A theoretical prediction of critical heat flux in saturated pool boiling during power transients.** Pasamehmetoglu, K.O.; Nelson, R.A.; Gunnerson, F.S. (Safety Code Development, Nuclear Technology and Engineering Div., Los Alamos National Lab., Los Alamos, NM (USA)). pp 57-64 of Nonequilibrium transport phenomena. Dobran, F.; Bankoff, S.G.; Chen, J.C.; El-Genk, M.S. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870816—).

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Understanding and predicting critical heat flux (CHF) behavior during steady-state and transient conditions is of fundamental interest in the design, operation, and safety of boiling and two-phase flow devices. Presented within this paper are the results of a comprehensive theoretical study specifically conducted to model transient CHF behavior in saturated pool boiling. Thermal energy conduction within a heating element and its influence on the CHF are also discussed. The resultant theory provides new insight into the basic physics of the CHF phenomenon and indicates favorable agreement with the experimental data from cylindrical heaters with small radii. Finally, various factors that affect the discrepancy between the data and the theory are discussed.

24501 **Transient direct-contact condensation on liquid droplets.** Pasamehmetoglu, K.O.; Nelson, R.A. (Safety Code Development Group, Nuclear Technology and Engineering Div., Los Alamos National Lab., Los Alamos, NM (USA)). pp 47-56 of Nonequilibrium transport phenomena. Dobran, F.; Bankoff, S.G.; Chen, J.C.; El-Genk, M.S. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870816—).

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

In this paper, direct-contact condensation on subcooled liquid droplets is studied in two parts. In the first part, simple design correlations for the condensation in a steady environment are developed based upon a conduction model. These correlations include the convective heat-transfer coefficient, condensation rate, total condensation, and the droplet-thermalization time. In the second part of the paper, the effect of a time-dependent saturation temperature on the condensation process is investigated. A rapid decrease in saturation temperature is typical of condensation environments in which the steam-supply rate is limited and condensation-induced depressurization becomes important. Design correlations are developed for condensation in an environment in which the saturation temperature decreases linearly with time. These correlations are graphically compared to the design correlations of the first part through a quasi-steady approach. The error associated with this approach is quantified as a function of the rate of change of the saturation temperature.

24502 **Flow visualization study of inverted u-bend two-phase flow.** Ishii, M.; Kim, S.B.; Lee, R. (Reactor Analysis and Safety Div., Argonne National Lab., 9700 South Cass Avenue, Argonne, IL 60439 (USA)). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Since the Three Mile Island Unit 2 accident occurred, numerous issues have been addressed in regards to the B and W 2 x 4 loop NSSS designs. In particular, some concern has been raised rel-

evant to the B and W NSSSs largely because of some unique components and hardware features in the plant design in addition to the 2 x 4 loop geometry. It has been suggested that unique design features of the B and W reactor may produce unique and complex thermo-hydraulic behavior during system transients. Flow visualization experiments were performed in a simulation loop. The experimental condition simulated the two-phase flow in a B and W primary loop during a small break loss of coolant accident or during some other abnormal transients. The loop design was based on the scaling criteria developed previously and the loop was operated either in a natural circulation mode or in a forced circulation mode using nitrogen gas and water.

24503 **Assessment of some interfacial shear correlations in a model of ECC bypass flow in PWR reactor downcomer.** Popov, N.K.; Rohatgi, U.S. (Electrical Engineering Dept., Univ. Kiril and Metodi, Karpos II, bb., 91000 Skopje (YU)). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

The bypass/refill process in the PWR reactor downcomer, following a large rupture of a cold leg coolant supply pipe, is a complicated thermo-hydraulic two-phase flow phenomenon. Mathematical modeling of such phenomena is always accompanied with a difficult task of selection of suitable constitutive correlations. In a typically hydrodynamic phenomenon, like ECC refill process of the reactor lower plenum is considered, the phasic interfacial friction is the most influential constitutive correlation. Therefore, assessment of the well-known widely-used interfacial friction constitutive correlations in the model of ECC bypass/refill process, is the subject of this paper.

24504 **Validation of elastic-plastic computer analyses for use in nuclear waste shipping cask design.** Koploy, M.; Schlafer, W.; Zimmer, A. (GA Technologies Inc., San Diego, CA (USA)). pp 433-438 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—).

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

GA Technologies designed the Defense High Level Waste (DHLW) Truck Shipping Cask using state-of-the-art analytical techniques verified by model testing performed by Sandia National Laboratories (SNL). The DHLW cask has a thick-walled stainless steel body and incorporates integral stainless steel impact limiters that protect the two ends of the cask during the hypothetical accident condition 30-ft free drop. These integral impact limiters absorb the drop energy through gross plastic deformations. GA used elastic-plastic computer codes developed at Los Alamos and Lawrence Livermore Laboratories, HONDOII and DYNA3D, to analyze for this non-linear behavior. In order to evaluate the analyses, GA developed elastic-plastic stress criteria that were adapted from the ASME Boiler and Pressure Vessel Code, Division I, Section III. This innovative design and analytical approach required test verification. Therefore, SNL performed 30-ft drop and puncture tests on a half-scale model of the DHLW cask. The testing confirmed that the analytical approach works and results in a safe, conservative design.

24505 **Progress towards developing consistent design and evaluation guidelines for US Department of Energy facilities subjected to natural phenomena.** Murray, R.C. (Lawrence Livermore National Lab., CA (USA)). pp 93-98 of Structural mechanics in reactor technology. Wittman, F.H. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870812—). Contract W-7405-ENG-48.

From 9. SMIRT: international conference on structural mechanics in reactor technology; Lausanne, Switzerland (17 Aug 1987).

Probabilistic definitions of earthquake, wind, and tornado hazards for many Department of Energy (DOE) facilities throughout the United States have been developed. In addition, definitions of the flood hazards which might affect these locations are currently being developed. The authors have prepared a document to provide guidance and criteria for DOE facility managers to assure that DOE facilities are adequately constructed to resist the effects of natural phenomena such as earthquake, strong wind, and flood. The intent of this document is to provide instruction on how to utilize the hazard definitions to evaluate existing facilities and design new facilities in a manner such that the risk of adverse consequences is consistent with the cost, function, and danger to the public or environment. A conference and six mini-courses were organized on natural phenomena hazards mitigation. This provided a mechanism for technology transfer to the DOE community. Complementary manuals have also been developed for 1) suspended ceiling systems and recommendations for bracing them, 2) practical equipment seismic upgrade and strengthening guidelines, and 3) suggested structural details for wind design. These manuals are intended to provide input and guidance for ongoing site safety programs.

24506 **A large-scale soil-structure interaction experiment: Part II EPRI/NRC research program on method validation.** Tang, Y.K.; Kassawara, R.P.; Tang, H.T.; Srinivasan, M.G.; Kot, C.A. (Electric Power Research Institute, Palo Alto, CA (USA)). pp 183-188 of Structural mechanics in reactor technology. Wittman, F.H. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870812—).

From 9. SMIRT: international conference on structural mechanics in reactor technology; Lausanne, Switzerland (17 Aug 1987).

Various seismic soil-structure interaction (SSI) analysis techniques have been developed and used for nuclear power plant design and licensing. The methods vary from those using simple spring and dash-port representations to more complexed finite element and substructure impedance methods. However, to data, relatively little effort has been devoted to validating the assumptions and approximations of the analysis techniques against structural and site response data recorded during actual earthquake events. In view of this, the Electric Power Research Institute (EPRI), with cooperation from the Taiwan Power Company (Taipower) has undertaken a large-scale seismic experiment in Lotung, Taiwan to collect earthquake response data for SSI method validation and evaluation. Since the completion of the construction of the facility in October 1985, eighteen earthquakes have been recorded at the site. With this data base, a cooperative SSI method validation program was initiated in 1986 by EPRI, U.S. Nuclear Regulatory Commission (NRC) and Taipower. This paper describes the approach and scope and also the data base of recorded earthquakes and the forced vibration tests to be used in the validation program.

24507 **(SCSIN-REP—5-2-D-86-REV-1) General Rules applicable to the Construction of Electrical Equipment.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Sep 1986. 12p. (SIN—3419-86). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752174/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. For electrical components, the use of the RCC-E (Design and Construction Rules for electrical equipment of Nuclear Islands) is accepted with conditions described in this RFS.

24508 (SCSIN-REP—5-2-C-86-REV-1) General rules applicable to the construction of mechanical equipment. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Jun 1986. 7p. (SIN—1627-86). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752194/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. For mechanical equipment construction, the use of the RCC-M (Design and Construction Rules for mechanical equipment of Nuclear Islands) is accepted with conditions described in this RFS.

24509 (SCSIN-REP—2-2-2-A-85-REV-1) Design of the containment spray system. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Dec 1985. 11p. (SIN—5037-85). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752208/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. The present RFS defines the functional requirements of the containment spray system and proposes certain complementary criteria or methods to be used in its equipment design.

24510 (SCSIN-REP—5-2-E-85-REV-1) General Rules applicable to the fabrication of fuel assemblies. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Oct 1985. 7p. (SIN—4440-85). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752175/JAW.

RFS or Regles Fondamentales de Surete (Basic Safety Rules) applicable to certain types of nuclear facilities lay down requirements with which compliance, for the type of facilities and within the scope of application covered by the RFS, is considered to be equivalent to compliance with technical French regulatory practice. The object of the RFS is to take advantage of standardization in the field of safety, while allowing for technical progress in that field. They are designed to enable the operating utility and contractors to know the rules pertaining to various subjects which are considered to be acceptable by the Service Central de Surete des Installations Nucleaires, or the SCSIN (Central Department for the Safety of Nuclear Facilities). These RFS should make safety analysis easier and lead to better understanding between experts and individuals concerned with the problems of nuclear safety. The SCSIN reserves the right to modify, when considered necessary, any RFS and specify, if need be, the terms under which a modification is deemed retroactive. For fabrication of fuel assemblies, the use of the RCC-C (Design and Construction Rules for fuel assemblies of PWR Nuclear Power Plants) is accepted with conditions described in this RFS.

25 ENERGY STORAGE

2506 Thermal

REFER ALSO TO CITATION(S) 24340

24511 (CONF-880457—2) Thermal analysis of heat storage canisters for a solar dynamic, space power system. Wichner, R.P.; Solomon, A.D.; Drake, J.B.; Williams, P.T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03. Order Number DE88004199/JAW.

From American Society of Mechanical Engineers Solar Energy Division conference; Golden, CO, USA (10 Apr 1988).

A thermal analysis was performed of a thermal energy storage canister of a type suggested for use in a solar receiver for an orbiting Brayton cycle power system. Energy storage for the eclipse portion of the cycle is provided by the latent heat of a eutectic mixture of LiF and CaF_2 contained in the canister. The chief motivation for the study is the prediction of vapor void effects on temperature profiles and the identification of possible differences between ground test data and projected behavior in microgravity. The first phase of this study is based on a two-dimensional, cylindrical coordinates model using an interim procedure for describing void behavior in 1-g and microgravity. The thermal analysis includes the effects of solidification front behavior, conduction in liquid/solid salt and canister materials, void growth and shrinkage, radiant heat transfer across the void, and convection in the melt due to Marangoni-induced flow and, in 1-g, flow due to density gradients. A number of significant differences between 1-g and 0-g behavior were found. This resulted from differences in void location relative to the maximum heat flux and a significantly smaller effective conductance in 0-g due to the absence of gravity-induced convection. 20 refs., 14 figs., 1 tab.

24512 (NP—8770083) Long-time material tests for the long-time heat storage prototype Wolfsburg. Final report. Breuer, W.; Redecke, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1986. 72p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770083/JAW.

Critical components of a long-time heat storage are the sealing and the covering. Within the scope of the project 'Long-Time Heat Storage Prototype Wolfsburg, Stage 1 - Planning Phase' which had been terminated at 1982, the material tests of steel and concrete, supports and foils has been started. The research at that time ran about one and a half year. The purpose of this following project was to extend the tests to more than four years and thereby to get more reliable results. It has been confirmed that reinforced concrete and elastomer supports are unrestricted usable in unpressurized heat storages. Some material properties of the HDPE-foils debased after about four years, therefore they appear to be unsuitable for a prolonged application at present. But it is expected that a substantial longer duration of life of HDPE is going to achieve by purpose-optimized further development. With 2 refs., 9 tabs., 23 figs..

24513 (PNL—6457) Literature review of market studies of thermal energy storage. Hattrup, M.P. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88007135/JAW.

This report presents the results of a review of market studies of thermal energy storage (TES). This project was conducted by Pacific Northwest Laboratory (PNL) for the US Department of Energy (DOE). PNL staff reviewed and consolidated the findings of existing TES market studies conducted in the industrial, commercial, and residential sectors. The purpose of this project was to review and assess previous work and to use the information ob-

tained to help provide direction for future technology transfer planning activities and to identify additional economic research needed within those three sectors. 37 refs.

24514 **Optimization and analysis of lithium hydride thermal energy storage device configurations for space power applications.** Siman-Tov, M.; Williams, P.; Olszewski, M. (Oak Ridge National Lab., Oak Ridge, TN). pp 175-182 of Proceedings of the 22nd intersociety energy conversion engineering conference. New York, NY; American Institute Aeronaut and Astronaut (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Technical Paper 879224.

Thermal energy storage (TES) can be used to reduce the area and mass of the heat rejection system in space-based sprint power systems. During the sprint mode power cycle, reject heat is placed into storage. This heat is then rejected to the ultimate sink over the much-longer nonoperational portion of the orbit, thus allowing the use of a smaller radiator. Preliminary analysis has shown significant weight advantage for the heat-storage-plus-radiator concept over the radiator-only concept. Thermal performance analysis and optimization of five heat sink TES configurations using lithium hydride (LiH) as the storage medium were completed. System performance was calculated for a wide range of parameters, including effects of pre-specified internal voids, enhanced thermal conductivity, and internal fins. After optimization and analysis, masses of storage materials, encapsulating shells, and containment vessels are determined to give total system operational energy storage and power densities (kJ/kg and kW/kg). The results show that LiH TES systems can provide significant performance capabilities with system energy and power densities ranging from 4 to 5 MJ/kg and 12 to 17 kW/kg, respectively. Among the five configurations analyzed, the alternating ring and the parallel slab configurations showed the highest system energy and power densities. The differences among configurations, however, were not extremely large.

2509 Batteries

REFER ALSO TO CITATION(S) 24599, 24601

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 24185

24515 **(JAERI-M—87-188) Progress in integrated energy-economy-environment model system development.** Yasukawa, Shigeru; Mankin, Shuichi; Sato, Osamu; Tadokoro, Yoshihiro; Nakano, Yasuyuki; Nagano, Takao. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752346/JAW.

The Integrated Energy-Economy-Environment Model System has been developed for providing analytical tools for the system analysis and technology assessments in the field of nuclear research and development. This model system consists of the following four model groups. The first model block installs 5 models and can serve to analyze and generate long-term scenarios on economy-energy-environment evolution. The second model block installs 2 models and can serve to analyze the structural transition phenomena in energy-economy-environment interactions. The third model block installs 2 models and can handle power reactor installation strategy problem and long-term fuel cycle analysis. The fourth model block installs 5 models and codes and can treats cost-benefit-risk analysis and assessments. This report describes mainly the progress and the outlines of application of the model system in these years after the first report on the research and development of the model system (JAERI-M 84 - 139).

24516 **(NP—8770111) Juechen-Nord energy supply concept.** Bruns, R.; Jank, R. (Bundesforschungsanstalt fuer Landeskunde und Raumordnung, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). 1986. 149p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770111/JAW.

The break down into uses shows almost three forths of the end use energy consumption to be falling to the heat market (space heating and process heat), meaning that the latter is an essential constituent of energy supplies as a whole. Building projects adding to the number of households and small users should make energy supply a basic element determining the structural features and the supply of buildings. The project discussed rises to these requirements with respect to the selection of sites for resettlements. The first step consists in the analysis or layout, respectively, of the building site and local plan according to the feasibility and limitations of an energy-conserving project. Step two consists in a comparative evaluation of the resulting supply alternatives. Step three informs about the requirements and advantages resulting from the variant selected for individual users.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 24099, 24296, 24505, 25022, 25023, 25096, 25650

24517 **(ISCA—8900364) Resources and human well-being: Inputs from science and technology.** (Indian Science Congress Association, Calcutta). 1987. 154p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88900364/JAW.

This book presents an overview at current thinking regarding the role of science and technology in decisions applying the use of natural resources to the best interests of the Indian people. Topics are very broad in scope and address most physical and biological resources as well as current social and cultural conditions that must be considered in India's future. Specific recommendations are included. (TEM)

24518 **(IWGES—860-195/005) Energy security in Canada: report of the Intergovernmental Working Group on Energy Security.** (Intergovernmental Working Group on Energy Security, St. John's, Newfoundland (Canada)). 24 Aug 1987. 30p. (MICROLOG—87-06007; CONF-8701107—). Canadian Intergovernmental Conference Secretariat, P.O. Box 488, Station A, Ottawa, Ont., Canada K1n 8V5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From Council of Provincial Energy Ministers meeting; Ottawa, Canada (30 Jan 1987).

This report contains summaries of papers prepared by the federal, provincial, and territorial governments on the issue of energy security in Canada. These papers have been reviewed by a working group of officials representing all the governments that participated in the January 30, 1987 meeting of the Energy Ministers in Ottawa. The papers represent an overview of energy security in its national and regional dimensions. They reflect differing perspectives on the energy security issue but four areas of common agreement emerge. First, energy security is an important aspect of energy policy which all governments should support. Second, an adequate policy addressing energy security involves a balanced mix of cost-effective planning for emergencies. Third, potential disruptions to oil supply remain the focus of concern but energy security issues affect all commodities. Finally, policies for energy security cannot deal with supply and demand alone. Included are summaries for Alberta, Saskatchewan, Ontario, Quebec, New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island, and Northwest Territories.

24519 (IWGES—860-195/006) Energy security for Canada: the oil supply option: Alberta. (Intergovernmental Working Group on Energy Security, St. John's, Newfoundland (Canada)). 24 Aug 1987. 13p. (MICROLOG—87-06005; CONF-8701107—). Canadian Intergovernmental Conference Secretariat, P.O. Box 488, Station A, Ottawa, Ont., Canada K1n 8V5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From Council of Provincial Energy Ministers meeting; Ottawa, Canada (30 Jan 1987).

Canada faces increasing dependence on imported crude oil if major new domestic sources of supply are not developed. Energy Ministers, Premiers, and First Ministers have recognized the risks this situation poses for oil supply security and have emphasized the need to develop national solutions. Canada possesses abundant indigenous oil resources in the offshore and oil sands. Any significant additions to Canada's light crude supply must come from these areas. The costs of these developments are not insurmountable and, in contrast to emergency preparedness measures, the social benefits, in terms of employment, balanced regional growth, and increased security of supply, outweigh the costs. Alberta proposes a committed and aggressive policy on the part of governments to get these projects going. 1 fig.

24520 (IWGES—860-195/007) Energy security: a discussion paper: New Brunswick. (Intergovernmental Working Group on Energy Security, St. John's, Newfoundland (Canada)). 24 Aug 1987. 11p. (MICROLOG—87-06000; CONF-8701107—). Canadian Intergovernmental Conference Secretariat, P.O. Box 488, Station A, Ottawa, Ont., Canada K1n 8V5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From Council of Provincial Energy Ministers meeting; Ottawa, Canada (30 Jan 1987).

At the January 30, 1987 Conference of Federal-Provincial-Territorial Ministers of Energy in Ottawa it was agreed that all Provinces and Territories would prepare discussion papers of "Energy Security" for submission to the Federal Government. New Brunswick believes that the goal of self sufficiency in oil supply should be secondary to that of overall security of supply in energy in all parts of Canada. Security of supply should not be restricted to oil alone but should consider all forms of energy including conventional and alternate energy as well as energy efficiency. The two main resources available to New Brunswick at this time in terms of security of energy supply are year-round ocean transport access to world oil and coal sources and a diversified electrical power generating system having strong interconnections with neighbouring Canadian and United States utilities. In terms of security of supply New Brunswick believes that market forces should be allowed to work in deciding the timing of major energy projects in Canada, all energy forms should be considered in formulating policy on energy security, and the Federal government should ensure that alternative energy supply systems are in place to provide security to all areas of the country.

24521 (IWGES—860-195/009) Energy security in Canada: Quebec's position. (Intergovernmental Working Group on Energy Security, St. John's, Newfoundland (Canada)). 24 Aug 1987. 3p. (MICROLOG—87-06002; CONF-8701107—). Canadian Intergovernmental Conference Secretariat, P.O. Box 488, Station A, Ottawa, Ont., Canada K1n 8V5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From Council of Provincial Energy Ministers meeting; Ottawa, Canada (30 Jan 1987).

Quebec accounted for 50% of Canadian imports of crude oil in 1985 and the National Energy Board predicts this ratio could reach 85% in 1995 with the development of Hibernia. The problem of energy security supply in Canada is thus primarily a problem of energy security in Quebec. Greater energy security in Quebec has been achieved through increased energy efficiency and the penetration of electricity, natural gas and wood. The opening of the Sarnia-Montreal pipeline has considerably reduced the need to buy oil on the world market. A number of measures could be implemented to ensure a higher degree of energy security in the coming years and thereby reduce Canadian dependence on oil imports. Descriptions are given from Quebec's view regarding supply and demand for measures that could be implemented.

24522 (IWGES—860-195/010) The viability of the Sarnia-Montreal pipeline: Quebec's position. (Intergovernmental Working Group on Energy Security, St. John's, Newfoundland (Canada)). 24 Aug 1987. 4p. (MICROLOG—87-06001; CONF-8701107—). Canadian Intergovernmental Conference Secretariat, P.O. Box 488, Station A, Ottawa, Ont., Canada K1n 8V5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From Council of Provincial Energy Ministers meeting; Ottawa, Canada (30 Jan 1987).

The Sarnia-Montreal pipeline is essential to Canada's energy security since it gives eastern Canada direct access to western oil and hydrocarbon resources. This pipeline's basic purpose is now in jeopardy as a result of the expected decline in production of light Canadian crude. Quebec feels that the situation presents an opportunity to consolidate and improve Canada's crude oil transportation structure. In addition to the light crude currently piped to Montreal, the pipeline could carry greater quantities of heavy oil, semi-finished product, and natural gas liquids. Ontario could be supplied with imported oil it is likely to require by linking the Interprovincial pipeline with the American pipeline system between the Gulf of Mexico and Sarnia.

24523 (NME—8708) Energy security for Canada: the Newfoundland perspective. Discussion paper. (Mercy Hospital and Medical Center, Chicago, IL (USA)). Aug 1987. 46p. (MICROLOG—87-06008). Canadian Intergovernmental Conference Secretariat, P.O. Box 488, Station A, Ottawa, Ont., Canada K1n 8V5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Government of Newfoundland and Labrador strongly recommends that Canada maintain a national policy for energy security. Canada has an abundance of energy supplies in many forms, but faces severe national supply shortages in the key commodity of light crude oil. Canadian energy policy must once again aim towards achieving the objective of national self-sufficiency in oil, and increasing energy supply in other forms where significant opportunities exist. Newfoundland can make a major contribution to Canada's energy security in the areas of offshore petroleum resources, hydro-electricity development, and conservation and alternative energy.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 24097, 24101, 24102, 24141, 24142, 24161, 24184, 24203, 24367, 24505, 24506, 24517, 24530, 24561, 24592, 24594, 25010, 25014, 25023, 25036, 25037, 25038, 25076, 25098, 25621, 25671

24524 (IIUG-pre—87-3) Information restrictions in environmental policy. A control-theoretical operationalisation of the prevention concept. Keck, O. (Wissenschaftszentrum Berlin fuer Sozialforschung gGmbH (EZB0) (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft). 1987. 30p. (In German). Wissenschaftszentrum Berlin fuer Sozialforschung g.G.m.b.H. (WZB) (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft.

Environmental policy in the past has generally reacted to problems only after harm has become manifest. Preventative environmental policy, by contrast, is to anticipate harm and to take measures early enough to forstall it. There are economic as well as ethical justifications for the prevention concept. Disorders in the informaton flow between the actors involved - such as the withholding and distortion of information - are a major cause for delays in environmental policy and hence provide a starting point for a more preventive orientation. For the different phases of the policy cycle, including problem recognition, the determination and assessment of alternative courses of action as well as implementation and evalua-

tion, specific information problems are determined and strategies to cope with them are discussed.

24525 **(MISA—870623) Development of an Ontario effluent monitoring priority pollutants list. A guidance document.** (MISA Priority Pollutants Task Force). 23 Jun 1987. 211p. (MICROLOG—87-05118). Ontario Government Publications, Publications Services, 880 Bay Street, 5th. Floor, Toronto, Ont., Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report recommends a chemical hazard assessment methodology for the on-going development of an Ontario Effluent Monitoring Priority Pollutants List (EMPPL). This hazard assessment is based on a chemical's environmental persistance, potential to bioaccumulate, acute and sub-lethal toxicity to biological organisms including humans, and potential to exist in effluents discharged to surface waters. This report also indentifies 180 chemicals or groups of chemicals which constitute the 1987 version of the EMPPL. The list represents those chemicals that have been detected or are potentially present in Ontario municipal and industrial effluents and pose a hazard to the receiving environment. In total, the Task Force considered over 1500 chemicals.

24526 **(ORNL—6405/R7) Environmental regulatory update table, December 1987.** Langston, M.E.; Nikbakht, A.; Salk, M.S. (Oak Ridge National Lab., TN (USA)). Jan 1988. Contract AC05-84OR21400. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88006046/JAW.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

24527 **(ORNL—6450/R1) Environmental regulatory update table, January 1988.** Langston, M.E.; Nikbakht, A.; Salk, M.S. (Oak Ridge National Lab., TN (USA)). Feb 1988. Contract AC05-84OR21400. 109p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE88006140/JAW.

Environmental Sciences Division Publication No. 3054.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 24219, 24220, 24222, 24227, 24247, 24248, 24249, 24252, 24256, 24260, 24284, 24291, 24297, 24298, 24302, 24303, 24304, 24305, 24306, 24307, 24308, 24309, 24310, 24311, 24312, 24314, 24316, 24317, 24322, 24323, 24513, 24530, 24532, 24548, 25605, 25650, 25680

24528 **(CONF-880212—5) Novel approaches: Licensing and industrial consortia.** Siemens, W.D.; Soderstrom, E.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006190/JAW.

From 15. annual energy technology conference and exposition; Washington, DC, USA (17 Feb 1988).

In 1984, the US Department of Energy and Martin Marietta Energy Systems, Inc., began implementing an experimental program to enhance the flow of technologies from a national laboratory to the private sector. Energy Systems has been able to pursue an aggressive licensing program in accordance with accepted commercial practices. Our approach includes negotiation flexibility which recognizes the unique circumstances of each technology, client, and market. A licensing strategy, developed for each technology, aims at maximizing its commercial potential. The license may include various terms and conditions, up to and including exclusive arrangements.

24529 **(PNL-SA—15500) Proceedings of the Molecular Science Research Center workshop: Chemistry at interfaces.** (Pacific Northwest Lab., Richland, WA (USA)). Jan 1988. Contract AC06-76RL01830. 120p. (CONF-8710246—). NTIS, PC A06/MF A01; GPO Dep. Order Number DE88005574/JAW.

From Molecular science research workshop; Richland, WA, USA (6 Oct 1987).

During October 6-9, 1987, three working groups examined the needs and opportunities for molecular-level research in support of DOE missions in health, environment, and materials. Several common themes emerged from these groups including the need for high-sensitivity, noninvasive techniques for examining interfaces, the in situ specification of the atomic geometries of biologically significant molecules, the establishment of explicit theoretical relationships between molecular-level data and large-space-scale, slow-time-scale macroscopic field-level phenomena, and the opportunities for qualitative advances in data analysis and modeling enabled by modern information technology, especially large-scale computing coupled with wide-band communications. Significant advances in these areas were regarded as requiring intense, focused interdisciplinary activity in which teams participated in the research at a variety of levels, from basic studies of molecular interface chemistry to the large-scale modeling of ecosystem or life processes.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 24139, 24141, 24142, 24161, 24162, 24203, 24415, 24416, 24417

24530 **(EML—501) Environmental Measurements Laboratory annual report, 1986.** Chieco, N.A.; Zamichieli, M. (eds.); Volchok, H.L.; de Planque, G. (USDOE Environmental Measurements Lab., New York). Aug 1987. 214p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88006215/JAW.

The 1986 Annual Report contains a series of short descriptions of each of the projects in which we were actively engaged. These technical summaries are grouped by broad programmatic headings under the organizational units of the Laboratory. Following the summaries, there are listings of the Laboratory's seminar program, staff activities, publications, publications in progress, and presentations. While the summaries generally appear in the principal investigator's division or branch section of the report, many of the projects are multi-organizational and are noted as such by the addition of all participants names, as well as by a system of cross referencing. A considerable diversion of effort was made in 1986 to work associated with the Chernobyl reactor accident. While some of the work is summarized here, all of the Laboratory's initial efforts regarding Chernobyl have been compiled in a single EML Report (EML-460), and more detailed interpretive reports are now being prepared for scientific journals.

2908 Waste Heat Utilization

24531 **(PB—88-142732/XAB) Evaluation of the economic potential for cogeneration in Illinois. Cogeneration market assessment, Phase 2.** Fields, D.L. (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). Oct 1987. 112p. (IL/ENR/RE/SP—87/15). NTIS, PC A06/MF A01.

See also report dated Jan 86, PB—86-153988.

The economic potential for cogeneration in Illinois was estimated using a cost-benefit model developed in cooperation with QED Research, and a data base of technical plant characteristics prepared by Synergic Resources Corporation in a separate study for the Department. Using the technical data, cogeneration-system characteristics and matches provided by QED, economic/financial assumptions and price projections for major utility service territories in Illinois, the economic potential for individual firms was estimated and then aggregated for each service territory. The sensitivi-

ty of these estimates was assessed by varying key parameters. Based on the limited sample of firms included in the study, total economic potential was estimated to be between 214 and 400 megawatts. The technology most likely to be used for industrial cogeneration was estimated to be a simple-cycle gas turbine.

2910 Conservation

REFER ALSO TO CITATION(S) 24098, 24517, 24518, 24520, 24521, 24522, 24523, 24545, 24552, 25650

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 24108, 24518, 24519, 24520, 24521, 24522, 24523, 24540

24532 (ERCB—87/40) Energy Alberta 1986: review of Alberta energy resources in 1986. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1987. 51p. (MICROLOG—87-05062). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This is an annual review of energy developments in the province with reference to national and international events as they have affected Alberta. It is published by the Energy Resources Conservation Board (ERCB) to provide an overview of Alberta's energy sector and its importance to the province. Another objective was to describe the operation of the ERCB. The energy sources discussed are oil, gas, oil sands, hydro, and coal with regard to sales, distribution, revenues, investment, employment and environmental issues.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 24089, 24107, 24142, 24162, 24249, 24255, 24259, 24284, 24291, 24526, 24527, 24530, 24537, 24541, 25022, 25079

24533 (INIS-XN—26) Order of 28 December 1983 on the Atomic Energy Commission's Advisory Committee on Transactions. (International Atomic Energy Agency, Vienna (Austria)). 12 Jan 1984. 1p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780070/JAW.

This Order provides in particular that projected transactions by the French Atomic Energy Commission (CEA) equal to or above one million francs must be submitted for advice by the Advisory Committee on Transactions. (NEA)

24534 (NP—8770100) Future without nuclear power. The 'Californian way' - energy the soft way - chances of a similar alternative for the Federal Republic of Germany?. Spitzley, H. (Bremen Univ. (Germany, F.R.). Fachbereich 11 - Arbeits- und Bildungswissenschaften). May 1986. 169p. (In German). NTIS (US Sales Only), PC A08. Order Number DE88770100/JAW.

The report deals with the reorientation of energy policy which took its start in the USA and, in particular, in California in 1978. The Californian success has its main roots in a consistent energy conservation strategy, in the promotion of dual-purpose power plants, and in the constantly increasing utilization of wind power. The discussion focuses on the reciprocal relation between the government, the different commissions and the electric utilities. With respect to conditions as they are in the Federal Republic of Germany the author discusses a similar development. Assuming an immediate radical withdrawal from nuclear power and a change of the political climate the prospects for such a development are considered positive.

24535 (NP—8770103) State measures to promote power generation and energy conservation in industry and trade. As of April 1986. Kaniak, J.; Riemer, W. (Energieverwertungsagentur (EVA), Vienna (Austria)). Apr 1986. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770103/JAW.

The list of measures presents decision aids for those in Austria who intend to apply for financial support by the state for projected energy conservation measures.

24536 (PIRSEM—1024) Energy politics simulation and optimization: models, methods and examples. Hennet, J.C.; Vassilaki, M.; Abatut, J.L.; Hezbri, M.; Samarakou, M.T. (Centre National de le Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matieres Premieres). Feb 1985. 62p. (In French). (LAAS—85026). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752387/JAW.

A method for the modelization of energetic systems is presented with emphasis on the technique of converting a descriptive scheme into a mathematical model (graph theory). Some examples are given concerning the evaluation of a solar plant with heliostats and central receiver, and of an energy conservation system through renewable energy utilization and the simulation and the optimization of a combined solar-wind-batteries-diesel motor power production system. The simulation technique is then extrapolated to the simulation and optimization of energy politics in a multisectorial economical context.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 24080, 24084, 24085, 24085, 24085, 24089, 24097, 24098, 24099, 24107, 24108, 24109, 24519, 24546, 24565

24537 (DOE/EI/19607—T1) Natural gas data needs in a changing regulatory environment. (National Research Council, Washington, DC (USA). Panel on Statistics on Natural Gas). 1985. Contract AC01-82EI19607. 170p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88005862/JAW.

Instability in international oil markets in the 1970s and early 1980s combined with natural gas shortages in the interstate gas market to generate a national debate over the nation's policy of wellhead price controls. As a result of the Natural Gas Policy Act of 1978, a large part of natural gas production was decontrolled on January 1, 1985, signaling a notable move towards more freely competitive field markets for natural gas. While changes are expected in how producers, pipelines, and distributors function as the industry adapts to more deregulated field markets, the precise nature of these changes is not yet clear and is not likely to be clear for some time. Good data about the natural gas industry is a necessary prelude to understanding how the industry functions and how deregulated field markets will affect consumers. In 1980 the Professional Audit Review Team criticized EIA for not initiating comprehensive data user surveys to determine the kinds of data that should be collected and disseminated. This critique, together with EIA management's commitment to improvement of its data planning activities, led EIA to request that the National Research Council form a panel to study user needs for natural gas data and to provide guidelines about cost effective means for determining whether or not user needs are being met. This document is the panel's report.

24538 (EC/E/CP—W&NR87/88/CP(EP)/4) Petroleum product storage and handling survey at federal facilities in the Manitoba Interlake. Youmans, T. (Environment Canada, Edmonton, Alberta. Conservation and Protection). Jul 1987. 54p. (MICROLOG—87-06109). Environmental Protection Service, Environment Canada, 351 St. Joseph Blvd., Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A survey of federal facilities in the Manitoba Interlake region was conducted to assess compliance with Manitoba Regulation 156/80 respecting the storage and handling of petroleum product. Inventory data were compiled and compared with the requirements of the regulation. The owners and operators of the storage tank systems were verbally apprised of deficiencies and proper procedures for carrying out an inventory reconciliation program. Compliance with the regulation was difficult to assess in a number of cases because of a lack of information on storage tank systems. Most installations, however, were found to be out of compliance with the provincial requirements.

2950 Hydrogen And Synthetic Fuels

24539 **(CONF-8703166—1) Natural gas transport, storage and distribution of the present - hydrogen transport, storage and distribution of the future.** Fasold, H.G. (Ruhrgas A.G., Essen (Germany, F.R.)). 1987. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770087/JAW.

From Hydrogen energy technology conference; Stuttgart, F.R. Germany (11 Mar 1987).

In what concerns its transport, distribution and storage, hydrogen, the potential future energy source is similar to natural gas as one of our present energy sources. While pipeline capacities are similar in both cases, compressors in the case of hydrogen have to be designed for engine outputs four times as high as in the case of natural gas. Higher engine outputs go hand in hand with higher fuel gas losses. Similar conditions apply to the storage of hydrogen, where, given the same energy content, storage volumes have to be about three times as great as those needed for natural gas. On principle, it is conceivable that existing or conveniently modified natural gas supply systems will in the future be used for the transport, distribution and storage of hydrogen. The natural gas/hydrogen switch-over could be made a continuous process which by mixing natural gas with increasingly higher shares of hydrogen would be completed after several decades.

2960 Electric Power

REFER ALSO TO CITATION(S) 24357, 24358, 24369, 24547, 24590

24540 **(CERI-S—87/2) A peak load forecasting model case study: the Alberta interconnected system.** Macrae, K.M. (Canadian Energy Research Inst., Calgary, Alberta). Jul 1987. 96p. (MICROLOG—87-04989). Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, Alta., Canada T2L 2A6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The growth in demand for electric power has fallen off, become more volatile and increased the uncertainty of load forecasting. Regulatory pressures have added significantly to lead times for installing new capacity, complicating the uncertainty. The nature of demand depends upon such factors as demand measure, time of use, customer profile, and planning. This study develops a model which accounts for these factors and examines their effects on system peak demand. The model presented tests the impacts of electricity price changes by sector on energy consumption and the demand for power. The model is then used to derive a peak load forecast consistent with a long-term forecast of customer energy sales. The final simulations of the peak-load forecasting model were used to evaluate the system-wide effects of a hypothetical load management program. The model also provides utilities with an analytical method for evaluating the benefits of improved system load factor relative to the expected costs of a given load management program. The model was applied to forecasting peak and system load factors for the Alberta Interconnected System. 17 figs., 10 tabs.

24541 (DOE/CH/10093—6, pp 266) **PURPA implementation: policy issues and choices.** Salgo, H. (Salgo & Lee, Boston, MA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The project is designed to marshall a comprehensive rationale and supportive policy and technical information, based on the Massachusetts Energy Office submissions during the 1985 intervention with the Department of Public Utilities, which asks the Public Utilities Commissions to require standard offer contracts and uniform methodologies subject to the provisions of PURPA. The contractor will prepare a report that will be understandable to policymakers, regulators, small power producers, and the financial community interested in small power production. The contractor also will provide technical expertise to any NRBP state undergoing a review of its PURPA implementation structure.

24542 **(DOE/EIA—0226(87/11)) Electric power monthly, November 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 19 Feb 1988. 45p. NTIS, PC A03/MF A01 - GPO; 1; GPO Dep. Order Number DE88006952/JAW.

Total net generation by electric utilities in the United States for November 1987 was 200,257 gigawatthours, 2% higher than the amount reported a year ago. All energy sources except water and petroleum reported higher levels of net generation over November 1986. Net generation from hydroelectric units produced 16,857 gigawatthours during November 1987, 27% below the amount reported a year ago. Hydroelectric net generation represented only 8% of the total US net generation. Net generation from petroleum-fired units produced 9805 gigawatthours during November 1987, 6% below the amount reported a year ago, but 44% above the October 1987 level.

24543 **(DOE/EIA—0437(86)) Financial statistics of selected electric utilities 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 26 Feb 1988. 1068p. NTIS, PC A99/MF A01 - GPO; 1; GPO Dep. Order Number DE88006833/JAW.

This report provides information about electric utility accounting and operations in a concise format to satisfy the needs of a wide variety of audiences. For the private sector, the information has been taken from the annual report of major private electric utilities provided to the Energy Information Administration for the calendar year 1986. 5 figs., 7 tabs.

24544 **(DOE/SWP—8007093) Southwestern Power Administration: 1987 annual report: Forging new partnerships.** (USDOE Southwestern Power Administration, Tulsa, OK). 1987. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007093/JAW.

The theme is "forging new partnerships." Covered in this annual report are: power sales, flood control, assets and investments, revenues and expenses, sources and uses of funds, financial statements, etc. (DLC)

24545 **(NP—8770101) Scrutinizing energy conservation - results of two National Fund studies. Abbreviated version.** Nydegger, A.; Baumeler, J. (Schweizerischer Nationalfonds zur Foerderung der Wissenschaftlichen Forschung, Bern). Sep 1986. 23p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770101/JAW.

Reference is made to the essential aspects of two studies on energy conservation in buildings and private households in Switzerland. The authors point out a considerable potential of improvements (29%) still remaining to be implemented. 21 theses give a numerical evaluation of the technically feasible and economically reasonable improvements. In addition, the reader finds a number of recommendations.

24546 **(YT/ECO—8706) Yukon energy statistics: a research paper.** (Yukon Territory, Whitehorse (Canada). Executive Council Office). Jun 1987. 55p. (MICROLOG—87-05394). Yukon Territory Bureau of Statistics, PO Box 2703, Whitehorse, Y.T., Canada Y1A 2C6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Data presented were derived from a number of sources including the Yukon Government, National Energy Board, Statistics Canada as well as private and public companies and are the most recent available as of May, 1987. This publication is subdivided into two main parts. Part A provides a comprehensive look at electricity data in the territory ranging from plant operations to electricity prices. Part B focuses on petroleum products, and time series data is provided at the product level.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 24532, 24542

24547 (DOE/EIA—0040-87) Typical electric bills, January 1, 1987. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 29 Jan 1988. 309p. NTIS, PC A14/MF A01 - GPO; 1; GPO Dep. Order Number DE88006892/JAW.

The cost of representative quantities of electricity (typical bills) to residential customers in most States was lower on January 1, 1987, compared with January 1, 1986. In the 500-kilowatthours consumption category, the average monthly bills reported for January 1, 1987, were lower in 30 States compared to the bills on January 1, 1986. Nationally, the average monthly bill was 3.9% lower on January 1, 1987. The 3 States with the greatest percentage change in lower bills were Hawaii, New York, and Florida with 22.9, 16.1, and 11.8%, respectively. The 3 States with the greatest percentage change in higher bills were Alaska, with 18.1%, followed by Arkansas and Tennessee with 11.2 and 10.2%, respectively. In the 750-kilowatthour consumption category, the average monthly bills on January 1, 1987, were lower in 29 States compared to the bills on January 1, 1986. Nationally, the average monthly bill was 3.4% lower on January 1, 1987. The 3 States with the greatest percentage change in lower bills were Hawaii, Delaware, and New York 23.8, 12.7, and 12.5%, respectively. The 3 States with the greatest percentage change in higher bills were Alaska, with 18.6%, followed by Arkansas and Tennessee with 11.2 and 10.3%, respectively. 4 figs., 51 tabs.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 24219, 24220, 24222, 24227, 24247, 24248, 24249, 24252, 24255, 24256, 24259, 24260, 24284, 24291, 24296, 24297, 24298, 24302, 24303, 24304, 24305, 24306, 24307, 24308, 24309, 24310, 24311, 24312, 24314, 24316, 24317, 24322, 24323, 24353, 24541

24548 (DOE/CH/10093—6, pp 364) Biofuels and municipal waste technology. Bull, S.R. (Solar Energy Research Institute, Golden, CO). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The Biofuels and Municipal Waste Technology (BMWT) Division produces the Multiyear Program Plan to document planning efforts and strategies for R & D in biomass energy, alcohol fuels, and energy from municipal wastes. The Program Plan is in draft form and has been reviewed by BMWT and the field centers (Argonne, Oak Ridge, and Pacific Northwest Laboratories). The plan is currently being revised to reflect comments received.

24549 (NP—8770086) Renewable energy sources. Present situation, projects, aims. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770086/JAW.

The comprehensive scientific works and practical experiences gained in the field of renewable energy sources (solar energy, biomass, geothermal energy) during the past 12 years have paved the way for a much more realistic size-up of conceptions such as these. It seems to be convenient to strike a balance now and arrive at definite statements as to - the outcome of a 12-year period of research and development in the field of renewable energy sources - the technologies remaining to be developed and those having reached a certain maturity already - future potential developments in the field of renewable energy sources from the point of view of relevant individuals and institutions - consensus or diverging views? - the evaluation of innovative and renewable energy technologies in view of the new conservation mindedness. In October 1986 the balance was submitted to about 60 representatives responsible for scientific research, economy and administration. The evaluations, modifications and supplementary proposals arrived at as the result of several discussion sessions have been integrated into the second and at the same time latest version of the balance whenever integration was possible. The latest version aims at contributing to a rational, positive and realistic handling of the hopes lying in renewable energy sources, as well as at being a convenient guide for future research policies.

30 DIRECT ENERGY CONVERSION

3005 Fuel Cells

24550 (MU/MMS—8504) Final report on synthesis of hydrogen-conducting solid electrolytes. Nicholson, P.S. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Metallurgy and Materials Science). Apr 1985. 10p. (MICROLOG—85-5939). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

NYS materials were made using spray-dried powders. A series of NYS pellets were ion-exchanged using KCl/NaCl eutectic mixtures to form the precursor KNYS. These samples were H/sub 3/0/sup +/ exchanged using constant current. The resultant HNYS pellets were then used to electrolyse steam at 100/sup 0/C. Scanning electron microscopic analysis of the original NYS sinters revealed glassy inclusions and these were hypothesised as the possible cause of electrolyte deterioration sometimes observed during the ion-exchange process.

24551 (TU/ME—8708) Development of a H/sub 2/ storage fuel cell system as a lightweight, mobile power supply. Final report. Ward, C.A.; Pataki, L.; Yee, D.; Findlay, R.D. (Toronto Univ., Ontario (Canada). Dept. of Mechanical Engineering). Aug 1987. 65p. Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C.

One objective was to create a 12 cell stack producing 30 W at 5.7 V. The 12 cell stack operating on pure hydrogen and oxygen exceeded this by more than 100%. The hydrogen generator system uses the reaction between calcium hydride, a solid powder, and water to liberate hydrogen gas. Two laboratory prototype generators were produced. One relies on water vapor evaporating through a membrane onto the calcium hydride bed and the other introduces a stream of water drops into the hydride bed. Either of the two generator systems will operate a fuel cell stack at steady state. The membrane generator can operate with the minimum hydrogen production/consumption mismatch. Excess hydrogen is vented. In excess of 90% of the hydrogen production is converted to electrical power in the fuel cell system when the membrane hydrogen generator is used. The water-drop generator can operate the 30 W fuel cell for an extended period. The water-drop generator has a poor hydrogen production/consumption mismatch. A hybrid system which combines the fast response of the water-drop system with the good utilization of the membrane system should be investigated in future work. Another objective was to produce an anode catalyzed with a palladium-rhodium catalyst instead of platinum catalyst. The Pd-Rh system is significantly less expensive on a mass basis and has a higher atom count per unit loading. With the projected improvements in the fuel cell system design, the energy density would be expected to increase from 85 W-hr/kg to 320 W-hr/kg. 29 figs., 3 tabs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

24552 **(DOE/EIA—0441(86)) Energy conservation indicators, 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 10 Feb 1988. 112p. NTIS, PC A06/MF A01 - GPO; 1; GPO Dep. Order Number DE88006949/JAW.

This report presents a summary and analysis of historical energy consumption trends and other data relative to the intensity of energy use in the United States. National and regional data are presented for the residential, commercial, transportation, and industrial economic sectors and for the aggregate of all sectors. Energy consumption data are adjusted for changes in economic, demographic, weather, and other variables, to focus on energy efficiency trends. This report was designed for a variety of uses, ranging from a reference guidebook on energy data and related statistical sources to an analytical tool which identifies some of the underlying factors that affect the intensity of energy consumption. The report is distributed to local and state governments, the Executive Branch, private industry, and to the public.

3201 Buildings

REFER ALSO TO CITATION(S) 24343, 24344, 24594, 25055, 25061

24553 **(CONF-871234—13) Mass transfer mechanisms for water adsorbed on silica gel.** Fraioli, A.V. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 8p. NTIS, PC A02. Order Number DE88005993/JAW.

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

Water adsorption measurements were carried out on a commercial silica gel desiccant in humidistat tubes employing saturated salt solutions to maintain controlled final equilibrium partial pressures of water vapor over the adsorbent samples. The humidistat designs permitted measurement of adsorption in the air-saturated mode, or in the evacuated mode, where the vapor pressure of the water reestablished by the wet salt slurry was the total gas pressure of the system. Evaluation of the water adsorption data on silica gel obtained under both humidistat conditions disclosed a novel solid-side mass transport mechanism not previously considered in desiccant system modelling. It is proposed that at or about 40% relative humidity, pore flooding on the external surface creates a meniscal force imbalance with respect to the menisci adjacent to unfilled voids within the interior of the particle. At this point and beyond to saturation, fluid flow in a manner analogous to wicking saturates the particle, and appears to be responsible for the appearance of the "second knee" in the observed classical BET Type IV isotherm. 18 refs., 7 figs., 1 tab.

24554 **(CONF-871271—1) Electric field probes for quantitative moisture measurements in building materials.** Courville, G.E.; Hylton, J.O.; Murray, W.P.; Blalock, A.; Remenyik, C.J. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006415/JAW.

From Symposium on mechanisms and measurement of water vapor and liquid water amount through materials; Bal Harbour, FL, USA (6 Dec 1987).

Three novel capacitance techniques for making moisture measurements in insulated roof systems are being studied at the Oak Ridge National Laboratory (ORNL). These are designated as the "Pin Probe," the "Thermocouple Probe," and the "Planar Probe." The Pin Probe, developed at the Massachusetts Institute of Technology (MIT), consists of two parallel lines of straight pins as the two probe electrodes. This is an intrusive probe that must be mounted within the system being tested. The Thermocouple Probe is also intrusive. Its use assumes that thermocouple junctions exist at known locations in the specimen for temperature measurements. The probe electronics allows high frequency capacitance measurements between thermocouples without interfering with their temperature measurement function. The third probe, the Planar Probe, is non-intrusive and consists of a series of equally spaced plate electrodes in a box that sits on the surface of the roof. These electrodes provide several independent electrical signals from overlapping depths within the roof system. An analysis procedure was developed to identify the electrical properties of successively deeper layers of material. Prototypes of each of these probes have been constructed and promising preliminary data are available. Probe calibration, circuit stability, and range of applicability are major outstanding issues that must still be addressed. 6 refs., 12 figs., 4 tabs.

24555 (CONF-8511298—, pp 4.1-4.20) **Possibilities to reduce heating costs of production plants and warehouses.** Rittmann, R. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen, Germany, F.R. Abt. Anwendungstechnik). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

Various measures for cutting the heating costs of industrial buildings are discussed. Starting with an analysis of the factors that influence the heat demand the author then looks at possibilities to reduce the costs through construction measures and reorganisation. Methods of heat recovery are described and illustrated with various examples. (HAG).

24556 (CONF-8511298—, pp 12.1-12.14) **Heat supply for residential and administrational buildings with heat pump centres (the local heat supply concept of RWE).** Rumpf, H.G. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen, Germany, F.R. Abt. Anwendungstechnik). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The author introduces RWE's organisational concept of local heating systems. The development of energy prices and other economic aspects are dealt with. Various local heat supply centres, which work with electric heat pumps are described. (HAG).

24557 **(DOE/BP/24689—1) An assessment of the self-evaluation of the Alcor Energy-Efficient Refrigerator Rebate Program: Final report.** (Columbia Information Systems, Portland, OR (USA)). 12 Nov 1987. Contract AC79-86BP24689. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88005296/JAW.

This report is an assessment of an evaluation of a sponsor-designed energy-efficient refrigerator project targeted at third-party purchasers (i.e., builders and developers). The Alcor Energy Efficient Refrigerator Project was funded by the Bonneville Power Administration and operated solely in Snohomish County, Washington, between January 1985 and July 1986. The project provided rebates to builders who installed energy-efficient refrigerators in new homes and apartments.

24558 **(DOE/CE/63484—T3) [Energy Related Business Development Grant Project: Final report].** (North American Indian Cultural Center, Inc., Akron, OH (USA)). [1986]. Contract FG01-86CE63484. 194p. NTIS, PC A09. Order Number DE88006407/JAW.

The Home Weatherization Assistance Program (HWAP) has served for many years any qualifying homeowner or renter regardless of race, sex of ethnic origin. The agenda is given for a DOE purchasing consortium conference. This document also includes: Ohio cost study, HWAP minimum program requirements, OMB revised A-102 forms, a furnace study, a landlord reimbursement study, and participants. (DLC)

24559 **(LBL—23287) The influence of glazing selection on commercial building energy performance in hot and humid climates.** Sullivan, R.; Arasteh, D.; Sweitzer, G.; Johnson, R.; Selkowitz, S. (Lawrence Berkeley Lab., CA (USA)). Jul 1987. Contract AC03-76SF00098. 20p. (CONF-8709245—1; BS—247). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005750/JAW.

From ASHRAE conference on air conditioning in hot climates; Singapore, Malaysia (3 Sep 1987).

This paper presents a comparative study in which commercial building perimeter zone electric energy (cooling, lighting, fan) and peak electric demand are analyzed as a function of window glazing type, with a particular emphasis on the use of glazings with wavelength-selective solar-optical properties. The DOE-2.1C energy analysis simulation program was used to generate a data base of the electric energy requirements of a prototypical office building module located in Singapore. Algebraic expressions derived by multiple regression techniques permitted a direct comparison of those parameters that characterize window performance in hot and humid climates: orientation, size, and solar-optical properties. Also investigated were the effects of exterior and interior shading devices, as well as interior illuminance level, power density, and lighting controls to permit the use of daylighting. These regression equations were used to compare the energy implications of conventional window designs and newer designs in which the type of coating and substrate were varied. The analysis shows the potential for substantial savings through combined solar load control and lighting energy use reduction with daylighting. 6 refs., 6 figs., 5 tabs.

24560 **(LBL—24378) Simulation of the steady-state transport of radon from soil into houses with basements under constant negative pressure.** de Oliveira Loureiro, C. (Lawrence Berkeley Lab., CA (USA)). May 1987. Contract AC03-76SF00098. 294p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88006345/JAW.

A theoretical model was developed to simulate this phenomenon, under some specific assumptions. The model simulates: the generation and decay of radon within the soil; its transport throughout the soil due to diffusion and convection induced by the pressure disturbance applied at a crack in the basement; its entrance into the house through the crack; and the resultant indoor radon concentration. The most important assumptions adopted in the model were: a steady-state condition; a house with a basement; a geometrically well-defined crack at the wall-floor joint in the basement; and a constant negative pressure applied at the crack in relation to the outside atmospheric pressure. Two three-dimensional finite-difference computer programs were written to solve the mathematical equations of the model. The first program, called PRESSU, was used to calculate: the pressure distribution within the soil as a result of the applied disturbance pressure at the crack; and the resultant velocity distribution of the soil gas throughout the soil matrix. The second program, called MASTRA, was used to: solve the radon mass-transport equation, and to calculate the concentration distribution of radon in the soil gas within the whole soil; and to calculate the entry rate of radon through the crack into the basement, and the final indoor radon concentration. A parametric sensitivity analysis performed on the model, revealed several features of the mechanisms involved in the transport of radon into the house. 84 refs., 66 figs., 16 tabs.

24561 **(LBL—24487) Selected protocols for conducting field surveys of residential indoor air pollution due to combustion-related sources.** Traynor, G.W. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 25p. (CONF-8704219—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006336/JAW.

From ASTM symposium on design and protocol for monitoring indoor air quality; Cincinnati, OH, USA (26 Apr 1987).

As buildings are tightened for energy conservation purpose, the concentration of indoor-generated air pollutants can increase. Federal agencies, state agencies, utilities, and public health organizations have an interest in indoor air-pollution levels and the impact various policy decisions will have on them. This paper identifies key parameters that affect indoor air pollutants levels from combustion-related sources and suggests protocols for measuring each parameter. Indoor air quality field studies should measure the indoor pollutant levels themselves and the key parameters that affect such levels. Key parameters such as appliance usage patterns, indoor pollutant reactivity rates, local ventilation effects, air exchange rates, and source usage driving forces are addressed. In addition, state-of-art measurement techniques, time sampling periods, and overall sample sizes needed are briefly discussed. 32 refs., 1 fig., 2 tabs.

24562 **(PB—88-157342/XAB) Net-benefits analyses of residential and commercial conservation programs. Final report.** (Resource Planning Associates, Inc., Washington, DC (USA)). 10 Mar 1978. 151p. (RPA-RA—78-04-88). NTIS, PC A08/MF A01.

GRI has undertaken a major research and development effort (R&D) related to residential and commercial energy conservation. To provide a sound basis for establishing project priorities, a net-benefits analysis was performed using a scenario approach. The two scenarios evaluated alternative assumptions regarding the size of the potential market between 1978 and 2000, under three assumed levels of funding. To facilitate the analyses, a set of reference technologies served as yardsticks for measuring the difference in efficiency and cost associated with the new technologies developed. Aggregate net benefits were then calculated as a function of potential market size and the rate of penetration of the new technologies into the market. The projects evaluated fall under one of four generic program areas: improved furnaces, retrofit improvements, heat pump development, and more efficient appliances.

24563 **(SPA—8111) Conceptual designs of high efficiency residential gas furnaces.** Wright, J.L.; Sullivan, H.F. (Spider Engineering Associates (Waterloo), Inc., Ontario (Canada)). Nov 1981. 156p. (MICROLOG—83-2945). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objective was to design a high efficiency residential gas-fired furnace. Conventional furnaces typically have a steady-state efficiency of approximately 80%. However, the off-cycle losses associated with cyclic operation result in seasonal efficiencies in the order of 60% or less. The new designs for high efficiency furnaces are presented. One of these is an air-based furnace design incorporating a low-temperature plastic heat exchanger in the condensing section with a novel, possibly patentable, feature to permit the use of the low temperature plastic material. The other design is a hydronic-combination unit that accomplishes both the space heating and domestic hot water heating functions in the same appliance. The space heating system can be either water-based or, with the provision of a blower-finned coil unit, air-based. Preliminary cost estimates indicate that both of the designs presented should be very competitive when compared to the cost of heating units currently available. 17 figs., 5 tabs.

24564 **Indoor air quality and human health.** Turiel, I. New York, NY; Chapman and Hall (1985). 200p. Chapman and Hall Ltd., 29 W 35 St., New York, NY 10001.

The air inside buildings can contain various threats to human health: cigarette smoke, fumes from fires and cookers, microbes, gases, allergens and fumes produced by household products or building materials. Higher standards of insulation and draught-proofing and more use of air conditioning can increase the problems. This book provides a summary of indoor air quality problems in homes, offices and public buildings. Contents: Preface; Introduction; Formaledhyde and other household contaminants; Radon; Particulates; Combustion products; Involuntary smoking; Energy-efficient buildings and indoor air quality; Control of indoor air pollutants; Indoor air quality problems in office buildings; Legal and regulatory issues; Appendices; Sources and suggested reading; Glossary; Index.

3202 Transportation

24565 **(DOE/PE—0080) Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Progress report one, Context and analytical framework.** (USDOE Assistant Secretary for Policy and Evaluation, Washington, DC). Jan 1988. 109p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE88006893/JAW.

Even as the nation continues to stress both the domestic production and the conservation of oil, it faces an increase in petroleum imports during the 1990's from Persian Gulf sources that could be disrupted or inflated sharply in price by forces beyond US control. Last spring, Energy Security: A Report to the President of the United States announced the launching of a broad-based assessment of the costs and benefits of a vehicle system for streets and highways that would be capable of shifting in large measure from gasoline and diesel fuel (both based on petroleum) to energy sources that are not tied to oil. This initial progress report, on the study that has been under way since then, sets the stage for further consideration and comment by the major involved parties from both the public and the private sectors - including the potential producers of the alternative energy sources themselves, as well as prospective manufacturers of the vehicles to use them. The purpose of this study is not to formulate specific national policy toward alternative fuels. Rather, it is to serve as a source of credible, balanced, analytical information about time-frames, costs, benefits, barriers of various kinds, and whether the general use of such fuels might develop in sufficient volume to replace millions of barrels of imported oil at some point, thus affecting world energy markets appreciably to the benefit of the nation.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 24110, 24261, 24277, 24278, 24333, 24531, 24555, 24556, 24603, 24604, 24938, 24939, 24940, 24941

24566 **(CONF-8511298—) Industrial electric process heat.** (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen (Germany, F.R.). Abt. Anwendungstechnik). 1985. 211p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

This booklet contains various papers on the utilization of industrial electric process heat presented at an experts' conference in Nuremberg. Economic aspects and methods of optimising the consumption of energy are the basis for looking at drying process, cogeneration of cold and heat cogeneration of heat and power and new concepts of central heating for buildings. (HAG).

24567 (CONF-8511298—, pp 1.1-1.21) **Industrial electric process heat - aspects of energy economy, production engineering and general economy.** Rudolph, M.; Schaefer, H. (Technische Univ. Muenchen, Germany, F.R. Lehrstuhl fuer Energiewirtschaft und Kraftwerkstechnik). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The author deals with the problems of electric heat technology. Starting with some general remarks on electric heat engineering, achievable temperatures, time-controlled dosage of power supply the author deals next with various temperature profiles and selective heating. Power density, heating speed, effective cross section, physical and chemical influence on the material which is to be heated and environmental pollution are investigated next. Factors which determine the energy demand of a process or method such as economic utilization of electric heat are investigated by looking at the heating of a bloom. Efficiency chains and primary energy expenditure are also considered. (HAG).

24568 (CONF-8511298—, pp 2.1-2.9) **Methodology for recording and optimization of the energy consumption.** Ebersbach, K.F. (Forschungsstelle fuer Energiewirtschaft, Muenchen, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

This report looks at the energy situation in various industrial companies, at the analysis of the former and at subsequent measures for energy saving. The energy flow diagram of a machine factory is used to determine its energy consumption and power demand. Furthermore the energy consumption and power demand of a car repair workshop, the energy balance of the boiling process in a brewery, the fuel demand of a tunnel furnace in a brickyard and the energy savings in a paper mill are explained. Other possibilities of saving energy, the expenditure of such measures and the eventual miscalculations are also analysed. Special attention is given to the correct use of measuring techniques for measurements to be carried out during energy analyses. (HAG).

24569 (CONF-8511298—, pp 3.1-3.13) **Energy concepts for industrial plants - aims, solutions, implementation.** Knoeringer, P. (Energieconsulting Heidelberg G.m.b.H., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The author deals with rational and environmentally safe utilization of energy in industrial production. He starts with introducing an energy concept and its flow chart and discusses the conditions under which the former can be successfully applied. Implementation of such a concept is explained by booking at a shop of the metal processing industry. Time schedules and approximate costs of such an energy concept are studied as well as the benefits of it. (HAG).

24570 (CONF-8511298—, pp 5.1-5.23) **Electric resistance heating - technology and examples from chemical-, food- and metal industry.** Decker, E. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen, Germany, F.R. Abt. Anwendungstechnik). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The author gives various examples from industry in order to describe the technology of electric resistance heating. The industrial energy consumption and the most important methods of generating electric process heat are investigated. The author then looks at resistance heating and compares direct and indirect heating. Various possibilities to apply resistance heating, for example conductive continuous heating of wires, are discussed. Various materials for heating elements, the use of fluidized-bed furnaces and resistance furnaces are explained. Finally the author looks at the various heating elements of different heating systems and the design of heating cables. (HAG).

24571 (CONF-8511298—, pp 6.1-6.16) **Infrared radiation for industrial drying and heating.** Thomas, R. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen, Germany, F.R. Abt. Anwendungstechnik). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The focus of this paper is on industrial utilization of thermal radiation. Some introductory remarks about infrared- resp. ultrared heating are followed by an analysis of the behaviour that the object which is to be dried shows within the field of radiation. Drying of paint and varnish, car repair painting and drying of pointing ink are the examples given for application of the infrared technique. Further examples from paper, textile and plastics-industry are given to complete the picture. (HAG).

24572 (CONF-8511298—, pp 7.1-7.28) **High-frequency drying in the paper- and textile industry.** Grassmann, H.C. (Siemens A.G., Erlangen, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The author looks at the problem of quick heating of fibres such as textile fibres, paper etc. The basic functioning of high-frequency (HF)-drying is explained, design and structure of an HF-dryer is described. HF-dryers for fibre cables, forming cakes, textile fibre glass, drying spools and paper are described. The problem of radioscreening is considered, energy costs and new applications are discussed. (HAG).

24573 (CONF-8511298—, pp 8.1-8.19) **Heat pump with electric motor in industrial production - applications, energy demand and economic aspects.** Broschk, J. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen, Germany, F.R. Abt. Anwendungstechnik). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

This paper looks at possibilities of recovering heat from waste heat sources with relatively low temperatures by means of heat pumps. The heat pump itself, various refrigerating agents, various types of compressors and the cost of such equipment is investigated. Some examples of applications are given in order to look at the cost of energy, the savings potential and the heat recovery from off-air and cooling water. A leather stretching machine is described with a view to its energy consumption and saving possibilities. (HAG).

24574 (CONF-8511298—, pp 9.1-9.8) **Cogeneration of heat and cold in industry.** Jensen, W. (Sabroe Kaeltetechnik G.m.b.H., Flensburg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The author deals mainly with compression machines which are driven by an electric motor. Some criteria are given which have to be considered when trying to cogenerate heat and cold. The field of application of mechanical refrigerating machines is illustrated by some examples. The possibility of the utilization of cold of untreated waste water and during electroplating is discussed as well as the use of heat pumps in the process of water cooling of injection moulding machines and the utilization of waste heat of a public utility operated heating station. Finally the period of amortization is calculated. (HAG).

24575 (CONF-8511298—, pp 10.1-10.19) **Cogeneration of heat and power - assessment of the economy by means of sensitivity analyses.** Dickopp, A. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen, Germany, F.R. Abt. Anwendungstechnik). 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The economics of cogeneration are studied by means of sensitivity analyses. Starting from general requirements the author then looks at a back-pressure steam turbine, gas turbines and a combustion engine system. Power generation during peak-load and constant load is dealt with as well as problems of efficiency and of the decision between the generation of heat or power. The problem of calculating the economic efficiency and the resulting sensitivity analysis is described. (HAG).

24576 (CONF-8511298—, pp 11.1-11.14) **Comparison of the energy consumption of static-converter-fed rotary current drives with blower characteristics.** Voss, E. 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770112/JAW.

From 5. conference and exhibition on energy supply concepts for industry (ENKON-5) and BMFT status seminar on rational use of energy in industry and RWE conference on industrial, electric process heat, and; Nuernberg, F.R. Germany (27 Nov 1985).

RWE-Information Prozesstechnik.

The energy consumption of various driving systems is assessed during normal operation. The author then describes the voltage controlled and the frequency controlled asynchronous motor as well as the frequency controlled synchronous motor. Various ventilator drives are compared. (HAG).

24577 (DOE/CH/10093—6, pp 309) **Cogeneration from biofuels - a technical guidebook.** Easterly, J.L. (Meridian Corp., Falls Church, VA). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of the guidebook is to provide potential biomass cogeneration users with sufficient information to evaluate the feasibility of biomass cogeneration for their particular industry. The guidebook southeast will address the complete spectrum of biomass energy resources that can be used in the southeast region, to dramatically illustrate the potential of biomass fuels. It will be targeted toward those plant managers and engineers who could readily use a biofueled system, but who are not knowledgeable about or aware of biofuel cogeneration potential and applications. The book will emphasize an applications and systems level understanding. It will cover the broad spectrum of issues that must be addressed for a biofueled cogeneration project, ranging from decision economics to planning, design, operation, and legal and environmental concerns. Detailed technical information will be limited to biofuel characteristics, an area where engineers' standard reference documents may be inadequate.

24578 (DOE/CH/10093—6, pp 349-351) **Characterization and utilization in phenolic resins of lignin from wood saccharification by mineral acids.** Glasser, W.G. (Virginia Polytechnic Institute and State Univ., Blacksburg). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The conversion of lignified biomass by carbohydrate hydrolysis and fermentation to liquid fuels usually produces substantial quantities of a lignin-rich residue. The yield of this residue is on the order of 35 to 40 wt. % of biomass processed, or approximately 7 to 10 lb/gal of ethanol produced. Although it is a useful fuel source for the generation of needed process energy, this residue, or parts of it, may also be useful as a resource for solid structural materials. This research is to explore conditions under which the lignin-rich residue from TVA's two-stage, hardwood-based, wood saccharification pilot plant can be used as a prepolymer for phenol-formaldehyde resin products and other thermosetting plastics. Six specific tasks were identified in the objectives of this study. They are to (1) isolate a uniform polymer fraction from the lignin-rich pilot plant residue; (2) characterize the chemical and molecular structure of the useful lignin fraction; (3) test the reactivity of this fraction with phenol, with formaldehyde and phenol in sequence, and with propylene oxide and analyze the reaction products; (4) synthesize phenolic resins with substitution levels in excess of 50% of phenol and evaluate these resins by thermal analysis; (5) test selected resins by shear block testing and prepare polyurethane thermosets by crosslinking with suitable diisocyanates; and (6) compare the performance of the phenolic resins and polyurethanes with those obtained with other lignins. Thermal analysis and shear block testing results are described.

24579 **(EGG-M—26787) Application and technology requirements for heat pumps at the process industries.** Priebe, S.; Chappell, R. (EG and G Idaho, Inc., Idaho Falls (USA); USDOE Idaho Operations Office, Idaho Falls). 1987. Contract AC07-76ID01570. 8p. (CONF-8709248—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006740/JAW.

From 9. annual industrial energy technical conference; Houston, TX, USA (16 Sep 1987).

There are basically three categories of equipment used to manage heat energy flows in an industrial process. First, heat exchangers are used to move heat through the process down the temperature gradient. Second, heat pumps are used to move heat through the process up the temperature gradient. Third, heat engines are used to convert heat to shaft power or electricity. The subject here is heat pumps, and they will be discussed relative to their potential for heat energy conservation in industrial processes. The large categories of applications in refrigeration and space heating are not addressed.

24580 **(EGG-M—33487) The Department of Energy's Energy Integrated Farm System program.** Breckenridge, R.P.; Corrigan, M.K.; Thompson, W.N.; Price, D.R.; Bramwell, D.L. (EG and G Idaho, Inc., Idaho Falls (USA); USDOE, Washington, DC; Florida Univ., Gainesville (USA)). 1988. Contract AC07-76ID01570. 30p. (CONF-880215—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006791/JAW.

From Energy from biomass and wastes; New Orleans, LA, USA (15 Feb 1988).

The Department of Energy (DOE) recently completed a program investigating the feasibility of integrating diverse energy production and energy conservation practices to reduce agriculture's dependence on fossil fuels. The Energy Integrated Farm System (EIFS) program was established in 1980 in response to the hardship imposed on US farmers by high fuel costs and unreliable fuel supplies. Seven farms located in various geographical regions of the US and Puerto Rico participated in the program. Each of these farms developed an energy integrated farm system project that used a unique combination of energy production and energy conservation methods to supply energy to the farm and reduce the farm's dependence on energy produced from nonrenewable sources such as coal and oil. Methods used at these projects included conservation tillage, solar heating, waste heat recovery, methane production from the anaerobic digestion of animal manure, electricity production from biogas, alcohol fuel production, fluidized-bed combustion of crop wastes, and computer-aided conservation irrigation. This paper gives a summarized report of the work done at the seven projects. It presents highlights and results, provides an overview of successes and problems and lists recommendations. 12 figs., 3 tabs.

24581 **(INTEG—8208) Fluidized bed evaporation of coal cake containing petroleum crude oil. Final report.** (INTEG, Vancouver, British Columbia (Canada)). Aug 1982. 73p. (MICROLOG—83-2946). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This study investigated the performance of a fluidized evaporator for the evaporation of petroleum crude oil for prepared coal-oil cakes. Sixteen test runs were conducted using a variety of coal-oil cake samples. The experimental apparatus performed well; the process appears technically possible with up to 97% of the crude oil content removed from the feed cake. The effect of process variables on the performance of the process was assessed. The most important process variable was the fluid bed temperature, which exhibited a linear correlation to product oil content. Physical properties of the metallurgical coal samples were apparently not adversely affected during trials with windbox temperatures under 470/sup 0/ C. 6 figs., 11 tabs.

24582 **(IOC—821022) COM combustion test: an I.O.C./EMR cooperative evaluation.** (Iron Ore Co. of Canada, Sept-Isles, Quebec. Energy Management Group). 22 Oct 1982. 64p. (MICROLOG—83-2285). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Iron Ore Co. of Canada has undertaken the cooperative evaluation of a combustion field trial of 50/40/10 coal-oil-water mixture fuel in its ore dryer as a substitute for Bunker oil. The slurry was transported over long distances and transferred to three tank trucks. Stability of the fuel remained unaffected during this haul. This test burn demonstrated that the fuel can be substituted in existing equipment without major alterations, and that dual-fuel firing can be retained if fuel flexibility is required. A low pressure-velocity burner successfully burned diesel oil and this mixture fuel.

24583 **(NP—8770084) Utilizing process heat from a sulfuric acid production plant. Final report.** Jost, J.; Wentzel, H.U. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 30 Sep 1985. 19p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770084/JAW.

After completing all actions, including the alterations during the third quarter of 1985, the facility is in full production since this time. Our goal to change the elimination of processing heat of the sulfuric acid production from counter-cooling water or fresh water from a river to utilization of the processing heat for heating purposes may be considered as successful. The facility fulfilled all our expectations. Beyond this, after optimization, it was possible to recuperate more heat than had originally been calculated. This venture may be considered as goal-setting for other comparable chemical plants. With 1 ref., 2 tabs., 9 figs..

24584 (NP—8770091, pp 27-37) **In-company inspection of industrial furnaces - a precondition for rational and ecological use of energy.** Alt, L. (Ferngas Nordbayern G.m.b.H., Bamberg, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient and non-polluting techniques for producing industrial glass.

The importance of furnace inspection in order to guarantee the best possible utilization of fuel for glass melting is explained by means of some examples. In order to determine the energy consumption of a furnace the glass industry uses rotameters and quantometers. The functioning of these and the calculations which have to be made, are explained. The gas suppliers support the companies with their advisory service. The possibilities that are offered are explained and discussed. (HLN).

24585 (NP—8770091, pp 38-53) **Thermal measurement and measurement of emissions from glass melting furnaces.** Rudolph, K.H. (Ruhrgas A.G., Essen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient non-polluting techniques for producing industrial glass.

Heat and emissions from glass melting end and a pot furnace were measured. The thermal efficiency of glass melting furnaces is checked by looking at the specific consumption data and the energy balance. The combustion process is evaluated with the help of the fuel air ratio, the percentage of additional fuel consumption and analyses of waste gas and mixture. Measured temperature values are used to discuss possibilities of heat recovery. The results from emission measurements concern dusty, vapourous or gaseous anorganic matter. Diagram and tables are used to discuss them. (HLN).

24586 (NP—8770091, pp 54-64) **Developments in the construction of glass melting furnaces.** Krottenthaler, B. (Horn, A. Soehne K.G., Ploessberg, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient non-polluting techniques for producing industrial glass.

A historical survey of glass melting furnaces is followed by a comprehensive description of the various types of pot furnaces. The advantages and disadvantages of the pot furnace, the circular furnace and the air furnace are compared. The development of the tank furnace is described in detail. The construction operation, melting performance, specific heat consumption and the best achievable glass quality of the bohemia-melter are discussed and compared to the pot-furnace. Electrically heated tank furnaces are briefly dealt with. (HLN).

24587 **(NZERDC—141) Oil conservation in food factories.** Huse, P.; Stockwell, D. (Massey Univ., Palmerston North (New Zealand). Food Technology Research Centre). Feb 1987. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900352/JAW.

Previous surveys in the food manufacturing industry in the late seventies showed that imported fuel oil was an important energy source and that this industry used nearly as much fuel oil as the meat and dairy industries combined. It was suggested that the imported fuel oil should be replaced by indigenous fuels and that energy saving should be investigated. The 1981/82 survey in this report showed that a significant proportion of these food factories had (24%) or were planning (26%) to change from fuel oil to another fuel, in particular natural gas. The proportion of energy derived from fuel oil relative to the total energy used had decreased from 73.5% to 52% between 1974 and 1982. While the food manufacturing industry is still largely dependent on oil as its major energy source, there has been a significant shift in recent years to natural gas and to a lesser extent coal and electricity. However, during the period 1978 to 1982, there was little attempt to reduce energy usage. Seventy-nine percent of the factories had not attempted any heat recovery and 57% of the factories had made no energy saving changes at all. 9 refs., 4 figs., 11 tabs.

24588 **(QE—8303) Caustic leach-electrowin process for treating electric arc furnace baghouse dust. Final report. 2 volumes.** (Questor Engineering Ltd., Toronto, Ontario (Canada)). Mar 1983. 198p. (MICROLOG—83-3600). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report investigates the feasibility of one method of removing zinc and lead from electric arc furnace baghouse dust on a laboratory scale. Recent studies and literature are reviewed with attention being given to the formation and characterization of dust. Alternative treatment and disposal options are briefly described. Caustic leach-electrowin testwork is reported. Based on the results of the testwork, flowsheets and material balances are derived and used for the conceptual design of a slave plant to treat 15,000 tonnes per year of dust to produce zinc metal. Target economics, comprising preliminary estimates of capital and operating costs and revenues using somewhat optimistic assumptions, are calculated based on recycling of leach residue to the electric arc furnaces. Economic, commercial and other considerations pertaining to treating dust at a slave plant as compared to a centralized facility are discussed. Conclusions and recommendations for further work are enumerated. 10 figs., 14 tabs.

24589 **(SNC/TD—8207) Study on energy conservation in the industrial minerals processing sector comminution: crushing and grinding. Final report.** Siddiqi, Z.A.; Tahmi, E. (SNC Group, Montreal, Quebec (Canada). Technical Development Dept.). Jul 1982. 210p. (MICROLOG—83-2117). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The potential of energy conservation rests on a proper selection of machinery, the control on the input characteristic of the feed, and the definition of the finished product requirements. As the constrains differ from industry to industry, the optimization of the components to conserve energy in the industrial processing sector comminution requires that proper selection of machinery be made for specific industry. Optimization of comminution circuits requires that the installed machinery power be fully utilized and that the feed supplied is homogeneous and continuous. Because the specific power consumption for crushing is lower than that for grinding, a reduction in the energy consumption of a comminution circuit would occur if the range of the crushing is increased. The application of process control over the entire comminution process would yield appreciable savings in the energy consumption provided the operating parameter of a given installation is known and defined. 55 figs., 10 tabs.

24590 **(EPRI-P—4463-SR-Vol.2-Pt.3) TAG (Technical Assessment Guide) Volume 2, Electricity end use: Part 3, Industrial electricity use, 1987: Special report.** (Resource Dynamics Corp., Vienna, VA (USA); Battelle Columbus Div., OH (USA)). Feb 1988. 830p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920224/JAW.

This Technical Assessment Guide (TAG) has been compiled for the use of EPRI staff and its contractors to provide a common basis for evaluating electric energy R and D alternatives. This fifth edition of the TAG divides the document into four volumes. This volume (2 of 4) contains evaluation procedures and data on technologies that use electricity as well as those using other forms of energy. This part covers the industrial sectors. It describes the levelized annual cost method for making comparisons among technologies from the end-user's point of view.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 24252, 24333, 24516

24591 **(CONF-871269—2) Effluent dewatering research for MSW [municipal solid waste] and wastewater treatment sludges.** Pearson, C.V. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005991/JAW.

From Anaerobic digestion program review meeting; Golden, CO, USA (1 Dec 1987).

Since 1983 the program for investigation of methods to achieve near energy independence in wastewater treatment plants has focused on two areas that have the greatest possibility for energy reduction and subsequent energy production in the processing of municipal wastewater. Development of a low energy process to produce combustor-fuel-quality sludge has been the primary focus of the program. Two processes have been investigated, namely, the BMI electro-acoustic process and the low-grade energy, contact-drier process being developed at Clemson University. Both processes have achieved solids concentrations of from 37 to 45% using no more energy than is required by conventional equipment to achieve 15 to 22% solids. The end-product is autogenous and appears to be capable of being burned for energy produc-

tion as a single fuel and is able to achieve the desired 1500 to 1700°F flame temperature required for odor control. 20 refs., 6 figs.

24592 **(CONF-8710280—1) Paradoxes of cleaning up the environment: Regulation and recycling.** Wolsky, A.M.; Katzman, M.T.; Daniels, E.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006007/JAW.

From Environmental pollution control: advance or retreat?; Arlington, TX, USA (4 Oct 1987).

One of the major objectives of public policy in the past two decades has been cleaning up the environment. Considerable resources have been expended in reclamation of the environment from past errors as well as reducing effluent flows that can cause harm in the future. Recycling can play a major role in protecting the environment as well as saving energy. In response to market incentives, recycling industries provide a large proportion of raw materials for iron and steel producers. The very regulations aimed at cleaning up the environment, particularly RCRA, threaten the viability of recycling industries. In the stream of discarded automobiles, there are signs that the recycling of potentially hazardous substances may diminish rather than increase. 13 refs., 4 figs., 1 tab.

24593 **(NP—8770088) Final report submitted by the Confederate Technical Commission for District Heating.** (Bundesamt fuer Energiewirtschaft, Bern (Switzerland)). Dec 1986. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770088/JAW.

The final report informs about the main activities of the commission and summarizes the essential factors determining the future of district heating in Switzerland. A survey introduces the members of the commission, the main activities of the teams, as well as working groups specializing in certain fields and subjects. The subjecs dealt with directly by the commission are listed together with an account of cooperative activities. Relevant marginal conditions and criteria for the development of district heating in Switzerland are the subject of further discussions. (HAG).

24594 **(NP—8770099) Handling energy in the cities - Western Berlin/Lyon - a case study. Air pollution abatement, energy supplies and heat supply of residential buildings.** Tepasse, H. (Hochschule der Kuenste Berlin (Germany, F.R.). Fachbereich 2 - Architektur). 1987. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770099/JAW.

The report refers to a comparative evaluation entitled 'municipal engineering'. It deals with the cities of Berlin and Lyon. Introductory explanations as to the analysis as such and the approach to the subject municipal sanitation - air pollution are followed by an analysis of the central and decentralized energy supply of residential buildings and of the combination of heating systems and ventilation in buildings. The comparative evaluation is part of an instructional research program.

3209 Education And Public Relations

24595 **(DOE/CE—0211) The eleventh report to Congress: Comprehensive program and plan for federal energy education, extension and information activities: Annual revisions.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of State and Local Assistance Programs). Jan 1988. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88007134/JAW.

The report draws together, in summary fashion, the various current Federal energy education, extension, and information efforts. The programs cover a range of energy applications and address many different and mutally exclusive audiences through an array of delivery mechanisms, including volunteer efforts, research and development initiatives, and intensively managed efforts aimed at specific audiences. This report reflects the coordination efforts of Federal agencies, states, local communities and private groups in carrying out these energy programs. The successes and accomplishments of the included programs are periodically evaluated to determine their continuing need and effectiveness. The results of these evaluations are reflected by the current programs and the emphasis these programs have placed on aspects of energy conservation and use.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

24596 **(NP—8770089) 100 years of the motor car. The history, technical development and the coming-of-age of the automobile in Germany.** Schroeder, K. (Inter Nationes e.V., Bonn (Germany, F.R.)). 1986. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770089/JAW.

One hundred years ago Benz and Daimler were paving the way for the age of motorization. An illustrated survey gives access to the development of automobiles, the development of production processes, and to the popularization of automobiles in the course of a century. Based on reviews of the most decisive works of the two car pioneers reference is made to different proto types and the beginning of the Mercedes era as well as to the roots and development of automobile giants in Europe and in the USA. Access is given to the legend of the Porsche VW Beetle model, the development stages the automobile industry was undergoing, and the enormous increase in which on the roads from 1950 to the present day. The review is followed by a chapter on the vehicle as an economic factor. The aspects discussed with regard to the vehicle of the future refer to electric-powered vehicles, electronics, computerization, pollution abatement, minimisation of fuel consumption and minimization of weights. (HWJ).

3301 Internal Combustion Engines

24597 **(NP—8770108) Diesel engines for passenger cars - requirements on future diesel engines for passenger cars.** Willenbockel, O. (Opel (A.) A.G., Ruesselsheim (Germany, F.R.)). 1987. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770108/JAW.

It is assumed that by 2000, every fifth vehicle will be a diesel. To achieve this goal, improvements are required with regard to dynamic driving characteristics, exhaust emissions, and noise reduction. The highest priority is given to economic aspects, i.e. low fuel consumption, high power density, low exhaust emissions, good starting performance, low thermal and mechanical loads, low fuel sensitivity, and low noise. Supercharging improves the driving characteristics. Particle emissions can be reduced by collectors, catalytic converters, and monolithic ceramic filters. High concentrations of aromatic hydrocarbons in diesel fuel have a negative effect on the ignition performance, exhaust and particle emissions. Cold-starting noise and idling noise can be reduced by encapsulation of the engine. (HWJ).

24598 **(ORF/EM—36005) Determination of wear on an ICE-CI injection pump handling 15% water/diesel fuel emulsion. Final report.** (Ontario Research Foundation, Mississauga (Canada). Dept. of Engineering and Metallurgy). 31 Mar 1982. 32p. (MICROLOG—83-2104). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A Bosch injection pump and nozzles representative of a diesel fuel injection system for compression ignition engines was operated on a closed loop test bench system for 3500 hours using a fuel emulsion of 15% water and 85% No. 2 diesel fuel. The test bench system was designed to simulate operation of a given mine vehicle operating through a defined load, haul and dump cycle. Qualitative analysis was performed on the injection pump, nozzles, and support system components during and upon completion of the test program. Problems relating to wear and erosion of the system components as a result of the fuel emulsion are identified.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 24576

24599 (EGG-EP—7780) GTE battery management system: State of charge indicator evaluation. Bennett, T.L.; Burke, A.F.; Hardin, J.E.; Hunt, G.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1987. Contract AC07-76ID01570. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006800/JAW.

This report gives a description of the battery management system (BMS), its history, components and function. The testing of two BMSs at GTE Laboratories is summarized. Certainly the bulk of this report is devoted to the INEL testing of the most troublesome component of the BMS, the Gould state of charge indicator (SCI). The SCI does track the battery state of charge but does not meet the requirement of +0, -20%. The limitations of the Gould SCI appears to be two things; (1) the 10kW discharge rate used to predict the remaining energy, and (2) high current peaks are not taken into account in calculating battery capacity. Software implementation of the Gould SCI is recommended for future work. 7 refs., 21 figs., 10 tabs.

24600 (EGG-EP—7946) Status of electric vehicle simulation programs at the INEL: Summer 1987. Burke, A.F. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1987. Contract AC07-76ID01570. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006745/JAW.

This report is an interim status of efforts at the Idaho National Engineering Laboratory to implement and improve several electric vehicle simulation programs. A qualitative assessment of the ELVEC, HEAVY, HYVEC, DIANE, and MARVEL computer codes is given. The report focuses on the two programs, ELVEC and HEAVY. The status of these programs as they exist August 1987, is discussed. Results of verification and validation testing on these programs are discussed. Range and energy economy predictions are compared with dynamometer test data for various vehicle/battery combinations. The predictions and data are found to agree to within 10% in most instances where test data are available. Second by second comparisons of battery power, current and voltage are made. Possible improvements and enhancements to ELVEC and HEAVY are suggested. An appendix includes typical input and output files for HEAVY and ELVEC. 8 refs., 16 figs., 16 tabs.

24601 (OTC—EV/87/01) Electric vans in courier service: six-month progress report. Hsu, W.; Duncan, J. (Ontario Ministry of Transportation and Communications, Ottawa (Canada)). Sep 1986. 48p. (MICROLOG—87-06086). Ontario Ministry of Transportation and Communications, Research and Development Branch, 1201 Wilson Ave., Downsview, Ont., Canada M3M 1J8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report summarizes the six-month operational results of two electric vans in courier service for a distance of 17 km each way. The results of the six-month period from May 1986-November 1986 are summarized in the report for distance, electricity consumption/cost, operational cost, battery charge time and survey public opinion.

3306 Vehicle Design Factors

24602 (CONF-8710116—6) Thermal conductivity of oxide ceramics. Williams, R.K.; Graves, R.S.; Yarbrough, D.W. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 6p. NTIS, PC A02. Order Number DE88005842/JAW.

From 25. automotive technology development contractor's coordination meeting; Dearborn, MI, USA (26 Oct 1987).

The phonon thermal conductivity of solids depends on temperature, grain size, solute content and the presence of conduction electrons. A study of these effects is reported, the materials studied included Al_2O_3-base ceramics and bcc Fe-base alloys. For ceramics, the effect of grain size is larger than expected from standard theory. This is not true for metals and also for ceramics at high temperatures. The magnitude of the grain size contribution can be quantitatively predicted by a new theory. The variation with temperature is as expected from theory and the effect of solute content is almost entirely due to the solute-solvent mass difference. 8 refs., 11 figs.

3307 Emission Control

REFER ALSO TO CITATION(S) 24861, 24866

24603 (BCU/ME—82) Prototype design of a flameproof exhaust system for diesel engines used in underground coal mines. Eley, N.G.; Mellgren, T. (British Columbia Univ., Vancouver (Canada). Dept. of Mechanical Engineering). [1982]. 43p. (MICROLOG—82-0480). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report describes the design of a flame proof exhaust for diesel engines. The design submitted is thought to be the simplest and the most maintenance-free. A diesel engine for underground coal mines requires to be naturally aspirated, to be a four cycle engine preferable with precombustion chamber and to be liquid-cooled engine. The engine chosen was equipped with a turbocharger. In assessing the design critieria for flameproofing, the following considerations were deemed as most important: the engine chosen would meet the British Coal Board Regulations, the servicing of the system should be such that maximum periods between servicing would be obtained, and all currently available engine accessories be used wherever possible. Details of the design theory and construction are provided.

24604 (HA—C2453) Diesel exhaust cooler development. Final report. Harding, R. (Hovey and Associates Ltd., Ottawa, Ontario (Canada)). 1982. 42p. (MICROLOG—82-0470). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Diesel powered equipment is used extensively in underground mining operations but the particulates and gaseous constituents of the exhaust gases present a health hazard for personnel. Exhaust gas filters on water scrubber units are used to capture these hazardous materials, but in the case of water scrubbers the hot exhaust gases carry off a great deal of water. The use of exhaust gas coolers reduces the amount of water needed to cool exhaust thus reducing the water burden in the mine atmosphere. In addition, coolers in conjunction with filters of scrubbers could improve performance, prolong unit life, and perhaps reduce the unit cost by reducing gas volumetric flow rate and temperature. This report covers the design and construct of a prototype heat exchanger to cool exhaust gas from a diesel engine.

24605 (IM—820412) Surface trial of the Corning ceramic diesel emissions filter. (Inco Metals Co., Copper Cliff, Ontario (Canada). Environmental Control Dept.). 12 Apr 1982. 10p. (MICROLOG—83-2874). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report addresses field testing of a ceramic diesel emissions filter. All parameters monitored during 48 hours of operation are indicated. Back pressures throughout the testing period remained relatively constant during various phases of the duty cycle. Documentation of the engine operating hours were measured and conditions noted during operation. Particulates were noticeably reduced during the test. The filter endured the 48 hour trial period. Further testing will be carried out to evaluated durability, effectiveness, and acceptability of the filters on a continuous operating basis.

24606 **(LU/C—8210) The effect of a Corning diesel exhaust filter on the PNA concentration and mutagenicity of diesel exhaust. Final report.** Faulds, A.J.; Westaway, K.C. (Laurentian Univ., Sudbury, Ontario (Canada). Dept. of Chemistry). Oct 1982. 66p. (MICROLOG—83-2869). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The effect of adding a Corning Diesel Exhaust filter to the exhaust system of a diesel was determined by analyzing the filters for PNAs and for nitro PNAs (i.e., the mutagenicity). The engine was mounted on a test stand in a 20′ x 10′ x 9′ (high) bunker and controlled by a chassis dynamometer. The samples were collected approximately 9 feet downstream from the end of the exhaust system on 8″ x 10″ teflon coated glass fiber filters. The temperature of the exhaust gases was measured in the exhaust system and at the sampling site. The concentrations of carbon dioxide, carbon monoxide, and the nitrogen oxides (NO/sub x/) were also determined in the raw or undiluted exhaust and at the sampling site. The samples were collected at both high and low controlled ventilation rates. Tests have shown that 80 to 95% of the particulate is removed by this filter. The soluble organic fraction of the particulate is also reduced significantly. Similar results have been obtained in field trials in underground mines.

24607 **(ORF—2580/2) Development of an emission control system for underground diesel powered equipment. Final report. Part 2: performance data.** Lawson, A. (Ontario Research Foundation, Sheridan Park (Canada)). [29 Mar 1979]. 54p. (MICROLOG—83-4471). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The desire to increase the number of diesel units used in underground workings in order to increase productivity, together with the corresponding economic limitations controlling any significant increase in ventilation rates, and the general desire to improve the quality of the mine atmosphere, has led to the need for development of an economic, efficient, and practically acceptable emission control device for underground diesel powered equipment. This report describes the performance of a catalyst/venturi scrubber test rig for reducing particulate emissions from a diesel engine derated for underground use. The design parameters of the venturi scrubber developed during the course of the project are recorded in Part 1. Particulate collection efficiencies of the scrubber were 55%. The result indicates that the collection complexity is probably too great for consideration in a metal mine, but might be justified in coal mine application where flame proofing of diesel engines is required. 3 figs.

24608 **(ORF/CAFU—4089/G) Adaptation of on-board diesel emissions reduction devices for a Jarvis Clark scoop tram. Final report.** (Ontario Research Foundation, Mississauga (Canada). Centre for Alternative Fuel Utilitzation). 17 Dec 1982. 39p. (MICROLOG—83-2877). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Exhaust gas recirculation (EGR) has been widely used as a method of reducing oxides of nitrogen emission. EGR combines a portion of the exhaust gas stream with the combustion air stream. The exhaust gases present in the air charge depletes the oxygen available for combustion and thereby reduces the peak flame temperature. Reduction of the flame temperature reduces the formation of nitrogen oxides. A Corning filter/exhaust gas recirculation emissions control system has been designed, fabricated, and installed on a scoop tram. Two exhaust outlet configurations were fabricated, one with a downward directing exhaust, the other with the exhaust pointing upward at a 25/sup 0/ angle relative to grade. Emissions of CO, THC, NO/sub x/, and NO were measured for three exhaust control strategies. Application of a combined ceramic filter with EGR has been shown to effectively reduce nitrogen oxides and particulate emission. 19 figs.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 24598

35 ARMS CONTROL

3502 Proliferation

24609 **(AD-A—186959/3/XAB) NATO's (North Atlantic Treaty Organization's) theater nuclear weapons and the defense of Europe: past patterns and future prospects. Master's thesis.** Stephenson, G.L. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1987. 71p. (AFIT/GLM/LSR—87S-73). NTIS, PC A04/MF A01.

The goal of this research was to analyze and order the controversy and ambiguity surrounding the TNW modernization started by NATO in 1979. To place the GLCM/Pershing II deployment within its historical context, this thesis reviews significant events pertaining to NATO since its inception. Three basic questions guided this study: Why did the NATO allies agree in 1979 to modernize their theater nuclear force. Why did the United States actually begin this TNW deployment in 1983. Is the TNW program accomplishing its goals. The first period reviewed (1948-59) is considered in terms of the United States' initial deployment of TNWs into Europe, the Soviet force buildup following World War II, and the creation of NATO in 1949. Section two traces NATO's changing attitudes towards TNWs from 1960-1974. The third section (1975-present) discusses the conventional and nuclear force balance, NATO's growing divisions during this period, and the role of the GLCM/Pershing II deployment within this environment of change for NATO. An examination of NATO's patterns of response over the last 38 years reveals that NATO has failed to develop formal organizational goals, choosing instead to react to each Soviet provocation on a case-by-case basis.

3503 Verification

REFER ALSO TO CITATION(S) 24209

36 MATERIALS

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 24081, 24375, 24375, 24377, 24379, 24387, 24394, 24394, 24410, 24410, 24410, 24429, 24461, 24464, 24464, 24468, 24567, 24711, 24711, 24812, 24911

24610 **(AERE-R—12664) Influence of thiosulphate ions on the localized corrosion of stainless steel.** Newman, R.C. (Manchester Univ. (UK). Inst. of Science and Technology). (UKAEA Harwell Lab. Materials Development Div.). Oct 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752745/JAW.

The. thiosulphate ion (S/sub 2/O/sub 3//sup 2-/) can be formed either by microbial activity or by air-oxidation of metal sulphides, e.g. in blast-furnace slag. Since blast-furnace slag may be added to concrete for nuclear waste containment, information on the corrosion effects of thiosulphate on stainless steels such as are likely to be used for waste canisters in contact with such concrete has been reviewed and areas requiring further study identified. In neutral solutions, thiosulphate is extremely corrosive towards stainless steels. Pitting corrosion has been reported for Type 304 steel in solutions containing less than 10/sup -5/ molar thiosulphate ions, provided that an appropriate amount of sulphate is present. Chloride ions are not necessary for pitting of this alloy. Two mitigating circumstances lead to the conclusion that Type 316L steel will probably not suffer from thiosulphate corrosion under disposal conditions. First, the concrete environment has a high pH (≧ 12.5), and this has been shown to inhibit pitting. Second, no pitting of Type 316L steel has so far been detected in solutions where sulphate (rather than chloride) is the predominant anion. Experimental

confirmation of the good resistance of Type 316L steel has been achieved using a scratching test.

24611 **(CEGB-TPRD/B—0892/R87) Electrochemical study of the effect of nitrate and sulphate on the corrosion behaviour of Magnox AL80 in pond environments.** Tyfield, S.P.; Martin, F. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752772/JAW.

The open circuit rest potential and the cyclic potentiodynamic polarisation behaviour of abraded Magnox AL80 has been studied at 22/sup 0/C in sodium hydroxide solutions (200 gm/sup -3/, pH ~ 11.6) dosed separately and with a combination of chloride and nitrate. The results are considered in terms of the effect of the presence of nitrate on the initiation of localised breakdown of the passive film on Magnox AL80. A similar study of the effect of the presence of sulphate in the sodium hydroxide medium (200 gm/sup -3/) is described and the aggressivity of sulphate is compared to that of chloride.

24612 **(CEGB-TPRD/B—0932/R87) Ignition of magnesium and magnox alloys. A review of data.** Pearce, R.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jul 1987. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752774/JAW.

Available data on the ignition temperatures of magnesium and the Magnox alloys of interest in CEGB Magnox reactor operations have been reviewed. Two basic ignition modes, instantaneous where a continuing and high rate of temperature rise is applied to the metal and delayed where the metal is held at a predetermined ambient temperature until ignition occurs, are identified.

24613 **(CFI—8205) Survey of requirements for plate steel in offshore structures and Arctic vessels. Final report.** (Chinook Fuel Innovations Ltd., Calgary, Alberta (Canada)). May 1982. 228p. (MICROLOG—83-2113). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Oil or gas have been found in promising or commercial quantities in both Canada's East coast and the Arctic regions. A similar development boom to that which the North Sea experienced is forecast for the Canadian East Coast, while the opening of the Beaufort Sea and the Arctic Islands to oil, gas and mineral developments promises Canada a significant technology position in Arctic transportation. However, Canada's environmental conditions are more severe. This report describes market survey and forecast to the year 2000 for thick steel plates of 25 mm and greater thickness. A critical evaluation of all planned projects was used to identify which are likely to be implemented during the forecasting period. An evaluation of current technology and assessment of future needs for all major hardware systems was then carried out for input into identification of thick steel plate needs for all equipment by project and year of plate order. The ability of Canadian industry to actually meet the demand to the year 2000 in offshore structure fabrications and Arctic shipbuilding was evaluated. The work concludes with suggestions for research and development programs. 45 figs., 24 tabs.

24614 **(CONF-870955—4) RF properties of superconducting Pb electroplated onto Cu.** Delayen, J.R. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 25p. NTIS, PC A03. Order Number DE88005918/JAW.

From 3. workshop on RF superconductivity; Argonne, IL, USA (14 Sep 1987).

The properties of Pb as a superconducting material for high power rf applications are reviewed. The most common method of producing Pb superconducting resonators, which is by electrodeposition of a thin layer on a Cu substrate, is described. 50 refs., 12 figs., 1 tab.

24615 **(CONF-871124—92) Ion-beam mixing and amorphization in Au/Zr bilayers.** Ding, Fu-Rong; Okamoto, P.R.; Rehn, L.E. (Argonne National Lab., IL (USA); Beijing Univ. (China). Dept. of Technical Physics). Nov 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005999/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Au/Zr bilayer films with inert-gas markers were produced by low energy (≦4 keV) implantation. Mass transport was measured during ion-beam mixing with 1 MeV Kr at several temperatures between 330 and 540K. Two distinct regimes of apparent Arrhenius behavior were found with activation enthalpies of 0.06 and 0.9 eV in the temperature range 330 to 440K and 460 to 540 K, respectively. Microstructural changes during ion-beam mixing were studied in situ, in a high voltage electron microscope. Heterogeneous nucleation of an amorphous phase was observed during mixing. Results are compared with similar studies reported previously in Ni/Zr bilayer specimens. 16 refs., 5 figs.

24616 **(CONF-871125—22) Laser enhanced adhesion of copper films to sapphire substrates.** Pedraza, A.J.; Godbole, M.J.; Kenik, E.A.; Lowndes, D.H.; Thompson, J.R. Jr. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006802/JAW.

From 34. national vacuum symposium and topical conference; Anaheim, CA, USA (2 Nov 1987).

Strongly adherent films of copper on sapphire can be grown by discrete and sequential sputter depositions alternating with pulsed laser treatment (PLT). In this work the influence of various processing parameters on the film adhesion and morphology are analyzed. Ultraviolet excimer lasers produce less damage to metallic films than do other visible or infrared pulsed lasers. However, the laser energy density must be carefully controlled in order to prevent excessive evaporation or film damage. Film damage and separation from the substrate is likely to occur during PLT if the initial copper films are thicker than 80 nm. Transmission Electron Microscopy reveals the formation of an intermediate copper/alumina compound in a 30 nm-thick film grown in two steps (10 nm + PLT = 20 nm + PLT). The regions of strong copper-sapphire bonding and good thermal contact that are established in the early stages of the sequential deposition process, and that are maintained during the subsequent process of building up a thick, adherent copper film, most probably consist of this intermediate compound. 13 refs., 5 figs.

24617 **(CONF-8412139—Summs.) Processing and applications of high melting point metals chromium, tantalum, niobium, molybdenum and tungsten. Summarized papers.** (Verein Deutscher Ingenieure (VDI) - Gesellschaft Werkstofftechnik, Duesseldorf (Germany, F.R.)). 1985. 105p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770113/JAW.

From VDI conference on the processing and application of the high-melting metals T1, Nb, Mb, and Tn; Koeln, F.R. Germany (6 Dec 1984).

This volume contains shortened versions of the lectures on high melting point metals on the following subjects: powder metallurgy, hot isostatic compression, ion implantation to increase protection against wear, tantalum coatings due to electrolysis of flow of melt, thermal spraying, explosive plating, TIG welding, special metals in the construction of chemical apparatus, in process technology, in plant and tool construction, mechanical properties and possible use in gas turbine construction. (IHOE).

24618 **(CONF-8705223—2) Nickel corrosion in 0.1 M NaOh: An in situ spectroscopic investigation using picosecond harmonic generation.** Pellin, M.J.; Biwer, B.M.; Schauer, M.W.; Gruen, D.M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 2p. NTIS, PC A02. Order Number DE88005768/JAW.

From Electrochemical Society meeting; Atlanta, GA, USA (15 May 1987).

We report the use of Surface Second Harmonic Generation (SSHG) to study the corrosion of Ni and NaOH solutions. SSHG has been extensively used to study the electrochemistry of Ag surfaces. Unfortunately, the signal levels from Fe and Ni surfaces are more than two orders of magnitude smaller for a given input intensity than for Ag. We have used the high peak intensity at a given input energy of picosecond Nd:YAG laser pulses to enhance the signal level of SSHG in studies of the corrosions of Fe surfaces. These studies as well as the present study of Ni electrodes demonstrate the feasibility of using SSHG as a routine in situ surface probe for the study of metal corrosion. 20 refs., 2 figs.

24619 **(CONF-8705226—4) Dynamical optimization techniques for the calculation of electronic structure in solids.** Benedek, R.; Min, B.I.; Garner, J. (Argonne National Lab., IL (USA); Bradley Univ., Peoria, IL (USA). Dept. of Physics). Aug 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006010/JAW.

From U.S.-Japan seminar on electronic structure and lattice defects in alloys; Honolulu, HI, USA (4 May 1987).

The method of dynamical simulated annealing, recently introduced by Car and Parrinello, provides a new tool for electronic structure computation as well as for molecular dynamics simulation. In this paper, we explore an optimization technique that is complementary to dynamical simulated annealing, the method of steepest descents (SD). As an illustration, SD is applied to calculate the total energy of diamond-Si, a system previously treated by Car and Parrinello. The adaptation of SD to treat metallic systems is discussed and a numerical application is presented. 18 refs., 3 figs.

24620 **(CONF-8708129—2) Depth of origin of sputtered atoms.** Jorgensen, B.; Pellin, M.J.; Young, C.E.; Calaway, W.F.; Schweitzer, E.L.; Gruen, D.M.; Burnett, J.W.; Yates, J.T. (Argonne National Lab., IL (USA); Pittsburgh Univ., PA (USA). Surface Science Center). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88005929/JAW.

From NATO-ASI conference on materials modification by high-fluence ion beams; Viana do Castelo, Portugal (24 Aug 1987).

The depth of origin of sputtered atoms is an important quantity in surface physics. The importance is best observed by examining the literature on computer simulations and theoretical calculations. It is hard to find experimental measurements of the depth of origin of sputtered atoms, which is probably due to the difficulty of such experiments. A good determination of the depth of origin should be done on a well characterized system and without damaging it. The results reported here are obtained from 1-2 monolayers of Cu on a Ru(0001) single crystal surface. The first 2 monolayers of Cu evaporated onto Ru(0001) is known to exhibit a layer by layer growth. The sputtering is studied in the Surface Analysis by Resonance Ionization of Sputtered Atoms(SARISA) apparatus, where it is possible to do the determination before the overlayer is damaged by the ion beam. One monolayer of Cu on Ru is found to give a ratio of 3.2 between Cu and Ru in the sputtered flux for 4 keV normal incidence Ar ions. 3 refs., 2 figs., 1 tab.

24621 **(CONF-8711126—2) Mechanisms and kinetics of ion beam-induced compositional modifications.** Lam, N.Q. (Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005998/JAW.

From Symposium on fundamentals of beam-solid interactions and transient thermal processing; Boston, MA, USA (30 Nov 1987).

Near-surface compositional modification of ion-bombarded alloys results from the dynamic interplay of several atomistic processes. In addition to displacement mixing leading to a randomization of atomic locations, which is dominant at relatively low temperatures, and preferential loss of alloying elements by sputtering, many thermally-activated processes, including radiation-enhanced diffusion, radiation-induced segregation and Gibbsian adsorption, also play important roles. The relative contributions of these processes to the evolution of the target composition profile depends on the target materials and irradiation variables. Although a good understanding of the individual processes has been achieved, information regarding their synergistic effects on alloy surface modification is still limited. In this article, these processes are characterized in simple physical terms, and the present understanding of their relative significance and contributions in changing the target composition during ion bombardment are discussed in view of recent progress in theoretical modeling and experimental study. 42 refs., 8 figs.

24622 **(DOE/ER/45310—6) On rotating sphere-on-a-plate experiments and the questions of whether high angle grain boundaries melt below bulk melting temperatures.** Balluffi, R.W.; Maurer, R. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering; Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.). Inst. fuer Werkstoffwissenschaften). 15 Jan 1988. Contract FG02-87ER45310. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006627/JAW.

A study on the melting of grain boundaries of rotating copper and silver spheres-on-a-plate was conducted in order to test whether metals undergo complete melting at temperatures below melting temperatures. Essentially all the boundaries in the experiments at 0.96 T/sub M/ and 0.99 T/sub M/ could not have been completely melted. Instead, it appears that they remained "crystalline" and that the rotations occurred because of the dependence of their energy on crystal misorientation. Possible situations include a variety of cases where the boundary is considerably disordered but where the atomic positions are still highly correlated with the atomic positions in the two grains adjoining the boundary slab. This conclusion is consistent with numerous previous interpretations of these experiments. 18 refs., 1 fig., 1 tab.

24623 **(DOE/ER/45310—7) Grain boundaries: Progress report.** Balluffi, R.W.; Bristowe, P.D. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). 1 Feb 1988. Contract FG02-87ER45310. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006628/JAW.

Quantitative measurements of grain boundary structure factors using x-ray diffraction have been performed on low angle [001] twist boundaries in gold. Also, a computer atomistic simulation program is being implemented to examine the equilibrium properties of a series of boundaries in gold. Simulation of boundaries at room temperature have been performed. Electron microscopy of grain boundary melting in aluminum was also performed. Results indicated an absence of melting. (CBS)

24624 **(EGG-M—12587) Characterization of an explosively consolidated rapidly solidified Fe-16Ni-9Cr-5Mo-2Cu alloy powder.** Korth, G.E.; Flinn, J.E.; Wright, R.N. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 6p. (CONF-880358—1). NTIS, PC A02. Order Number DE88006733/JAW.

From 2. international conference of rapidly solidified materials; San Diego, CA, USA (7 Mar 1988).

Vacuum gas atomized Fe-16Ni-9Cr-5Mo-2Cu alloy powder was dynamically consolidated using explosive techniques. The microstructure and tensile properties were evaluated in the as-shocked condition and after various heat treatments. Results showed the product to be fully dense and in a shock hardened condition after consolidation. Low bulk temperatures from the dynamic consolidation process allowed retention of the rapidly solidified microstructure of the powder except for the thin interparticle areas where metallurgical bonding (melting) has occurred. Thermal treatments resulted in decreasing strength as ductility increased. Microstructural observations and x-ray line broadening analysis were consistent with the changes in tensile properties. 7 refs., 7 figs., 1 tab.

24625 **(EGG-M—13586) Modelling particulate injection in thermal plasma material processing experiments.** Varacalle, D.J. Jr.; Lassahn, G.D.; McIlwain, M.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 26p. (CONF-8611105—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005534/JAW.

From Reinhardt Schuhmann international symposium on innovative technology and reactor design in extraction metallurgy; Colorado Springs, CO, USA (9 Nov 1986).

As part of the research on thermal plasma processing of materials, the trajectories and heating of particles injected into an argon plasma were investigated. In this study, which involved the carbothermic reduction of alumina, the temperature and velocity fields of the plasma column and plume were calculated first. Then, the particle dynamics and heat and mass transfer of the injected species were solved with corrected drag and head and mass transfer coefficients. In addition, the coupling effects between the multiple injected particles and the plasma plume were taken into account. The argon plasma was generated in a direct current, free length arc torch that can be operated at powers from 5 to 25 kW. 29 refs., 8 figs.

24626 (EGG-M—27587) Influence of consolidation method on structure/properties of rapidly solidified Type 304 SS powders. Flinn, J.E.; Korth, G.E.; Wright, R.N. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 11p. (CONF-880358—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006737/JAW.

From 2. international conference of rapidly solidified materials; San Diego, CA, USA (7 Mar 1988).

The structure/properties of consolidated, centrifugally atomized (CA) Type 304 SS powders containing ~8 appM helium entrapped during powder processing were evaluated. Three powder consolidation methods were used in the study: hot extrusion, hot isostatic pressing (HIPping), and dynamic (using explosives). In addition, cold-rolled 50% HIPped material was included in the evaluation. The four forms of consolidated powders were fully dense and possessed good bond strengths. The bond strength of the HIPped powders was the lowest. The consolidated materials were subjected to 1 h heat treatments and their grain growth, tensile, and creep behaviors were compared with those of wrought ingot metallurgy Type 304 SS materials. Grain growth of the CA Type 304 SS consolidated powders was substantially lower than for the wrought material. Similarly, significant strengthening was observed for the powder materials. The apparent microstructure stability and strengthening observed for the consolidated powder materials is attributed to the entrapped helium. 5 figs., 4 tabs.

24627 (EGG-SCM—7219) Grain growth behavior of extrusion consolidated centrifugally atomized Type 304 stainless steel powder. Flinn, J.E.; Wright, R.N.; Korth, G.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1987. Contract AC07-76ID01570. 59p. NTIS, PC A04/MF A01. Order Number DE88006788/JAW.

A study was performed to assess the role of entrapped helium in stabilizing the microstructure. Type 304 stainless steel powders produced by centrifugal atomization (CA) were consolidated by hot extrusion. The powders contain ~7 appM He which was retained during extrusion. Isothermal heat treatments were performed on the CA 304 SS extruded powder as well as on the attached wrought ingot metallurgy (I/M) can and a filler plug of Type 304 SS for comparisons. Compared with the wrought I/M Type 304 SS, the CA Type 304 SS extruded powder exhibited considerable grain growth retardation. Grain growth was shown to be independent of the means used for powder consolidation, including hot isostatic pressing and dynamic consolidation. Also, other CA consolidated alloy powders exhibited grain growth resistance equal to the CA Type 304 SS extruded powder. Results indicate that the entrapped helium in the CA consolidated powder materials plays a significant role in retarding grain growth. 23 figs., 5 tabs.

24628 (GKSS—87/E/2) Determination of crack initiation data and crack growth resistance curves for elasto-plastic fracture mechanics, applying the J-integral - draft of a DVM standard test method. Cornec, A.; Heerens, J.; Schwalbe, K.H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1987. 12p. (In German). (CONF-8611229—). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude, Germany, F.R.

From Lecture and discussion meeting on materials testing, with posters; Bad Hauheim, F.R. Germany (27 Nov 1986).

The working group on 'Determination and application of fracture mechanics parameters' that exists since 1984 within the DVM (German Association for Materials Testing) has worked out a DVM draft version of a standard method for determining crack initiation data and crack growth resistance curves by application of the J-integral as a fracture mechanical parameter. The draft takes into account the ASTM E813-81 and presents improvements with regard to crack initiation and the crack growth curve determination, presented in one standard document. The draft is intended for the case of steady crack growth in metallic materials, and for ductile fractures only. The most significant steps of the method are explained. (orig./IHOE).

24629 (IC—87/135) Precipitation study by electrical resistivity measurement in Ni-Al alloys. Ansari, M.I. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701877/JAW.

Results of a resistomatric study of an Ni-13.1 at.% Al alloy show that the initial increase in resistivity can be related to the segregation of solute atoms into smaller coherent clusters or zones, during aging after quenching, in a wide temperature range. Furthermore, the Al solute concentrations in equilibrium with γ'-precipitates in this alloy are also investigated. (author). 16 refs, 5 figs.

24630 (IC—87/138) Abnormal diffusion of vacancies in metals. Zhu Huilong; Huang Zuqia. (International Centre for Theoretical Physics, Trieste (Italy); Beijing Normal Univ., BJ (China). Inst. of Low Energy Nuclear Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701880/JAW.

The vacancy-concentration effect on the vacancy-migration-energy and the behaviour of divacancies were considered in deriving a formula for the vacancy-current in bcc metals. It turns out that vacancies will migrate in the direction of increasing concentration, when the concentration is greater than some critical value determined by a reasonable physical condition. The method in this paper can be extended easily to other metals. (author). 7 refs, 4 figs.

24631 (IC—87/152) Image force expression for the dislocation near a crack. Zhou, S.J.; Lung, C.W. (Academia Sinica, Shenyang, LN (China). Inst. of Metal Research). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701894/JAW.

Using the conformal mapping technique, the image force expressions for the dislocation near an elliptic hole and a semielliptical (edge) hole have been derived respectively. Let the short axis of the ellipse approach zero, the finite length crack limit solution was obtained, which was in agreement with the result obtained by use of method of dislocation model for the crack. (author). 13 refs, 10 figs.

24632 (IC—87/161) Study of field induced hot-electron emission using the composite microemitters with varying dielectric layer thickness. Mousa, M.S. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701903/JAW.

The analysis of the measurements obtained from the of field emission of electrons from composite metal-insulator (M-I) micropoint cathodes, using the combination of a high resolution electron spectrometer and a field emission microscope, has been presented. Results obtained describe the reversible current-voltage characteristic, emission images and electron energy distribution measurements of both thin and the optimum thick coatings. The observed effects, e.g. the threshold switch-on phenomena and the field-dependence of the F.W.H.M. and energy shift of the electron spectra have been identified in terms of a field-induced hot-electron emission (FIHEE) mechanism resulting from field penetration in the insulating film where conducting channels are formed. The theoretical implications accounts for the channels field intensification mechanism and the conduction properties with applied field, and the F.W.H.M. dependence on electron temperature. The control of the emission process at low fields by the M-I contact junction and at high fields by the bulk properties of the insulator have also been accounted for. These experimental and theoretical findings have been shown to be consistent with recently published data on M-I microstruc-

tures on broad-area (BA) high-voltage electrodes. (author). 18 refs, 6 figs.

24633 (INIS-BR—938) Corrosion of AISI 304 stainless steel in polluted seawater. Brankevich, G.; Guiamet, P.; Videla, H.A. (Associacao Brasileira de Corrosao, Rio de Janeiro). 1987. 10p. -(In Spanish). (CONF-8705180—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88701746/JAW.

From 14. national seminar of corrosion; Sao Paulo, Brazil (11 May 1987).

The sequence of microbiofouling settlement on AISI 304 stain steel samples exposed to polluted harbor sea water of a power cooling water intake is studied. The firts sates of bacterial colonization are followed by means of scanning electron microscopy during two weeks of exposure. The relation between microbiofouling and corrosion is also followed by scanning electron microscopy and evaluated through electrochemical polarization experiments. The results obtained show that microbial colonization and extracellular polimeric substances forming the biofilms have a marked influence on the electrochemical behaviour of stainless steel in sea water. Laboratory experiments using inorganic chloride solutions or artificial sea water show a considerably lesser attack of the metal than those performed 'in situ' with natural sea water. Passivity breadown is highly facilitated when complex biological and inorganic deposits (fouling) have settled on the metal surface.

24634 (INIS-mf—11615) Experimental and numerical simulation of the behaviour of building components under alternating thermal stresses. Stegmeyer, R. (Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.)). 1985. 192p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88752027/JAW.

Technisch-wissenschaftliche Berichte der Staatlichen Materialpruefungsanstalt, Universitaet Stuttgart.; no. 85-01.

This publication is intended to clear up to what extent the results from laboratory experiments on components thermally stressed on several axes can be transferred. The turbine shaft was used for this purpose and was geometrically simulated on a reduced scale by means of a test body (model). The deviations of shape due to the design, such as shaft shoulders, grooves etc. were simulated by notches and the position of the expected crack was defined in this way. A 1% Cr steel was selected as the material, for which many results of experiments on laboratory samples were available. The turbine shaft steel 28 CrMoNiV 4 9 was used. With a specially designed experimental rig, it was possible to expose the model to a changing temperature stress, as it occurs during starting and shutdown of turbines. Different notch radii made it possible to vary the strains at the bottom of the notches due to temperature gradients. After developing special travel transducers, the strain behaviour of the sample could be determined relative to the temperature. The crack characteristics obtained were compared with the characteristics of single axis experiments at constant temperature. Fractographic examination of fatigue cracks made it possible to determine the growth of cracks per load change from the existing vibration strip (da/dN). The stress intensity factor was derived from a modified theoretical expression and the characteristic designed from it was compared with crack growth measurements on CT samples. Accompanying numerical and empirical processes (according to Neuber) were examined by direct comparison of the measured strains with the calculated or estimated strains. Finally, regulations such as the ASME code and TRD 301 were applied to the model experiments and evaluated.

24635 (INIS-mf—11629) PAC investigations to the oxidation of /sup 111/In in fcc metals and their oxides. Bolse, W. (Goettingen Univ. (Germany, F.R.). Fachbereich Physik). 31 Oct 1986. 144p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752250/JAW.

By means of the PAC method the oxidation of /sup 111/In in fcc metals is investigated. Therefore the /sup 111/In implanted metals Ag, Al, Au, Cu, Ni, Pd and Pt are tempered in 200 mbar O/ sub 2/ after the annealing of radiation effects and the PAC parameter is determined as a function of the oxidation temperature. Moreover, the PAC parameter is determined for /sup 111/In in AgO, Ag/sub 2/O, CuO, Cu/sub 2/O, NiO and In/sub 2/O/sub 3/, by which the formation of these oxides can be identified in the corresponding metals. (BHO).

24636 (JAERI-M—87-151) Studies on neutron irradiation effects of iron alloys and nickel-base heat resistant alloys. Watanabe, Katsutoshi. (Japan Atomic Energy Research Inst., Tokyo). Sep 1987. 111p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752324/JAW.

The present paper describes the results of neutron irradiation effects on iron alloys and nickel-base heat resistant alloys. As for the iron alloys, irradiation hardening and embrittlement were investigated using internal friction measurement, electron microscopy and tensile testings. The role of alloying elements was also investigated to understand the irradiation behavior of iron alloys. The essential factors affecting irradiation hardening and embrittlement were thus clarified. On the other hand, postirradiation tensile and creep properties were measured of Hastelloy X alloy. Irradiation behavior at elevated temperatures is discussed.

24637 (JAERI-M—87-152) Effect of strain rate on high-temperature low-cycle fatigue behavior of hastelloy X and hastelloy XR. Tsuji, Hirokazu; Kondo, Tatsuo. (Japan Atomic Energy Research Inst., Tokyo). Sep 1987. 43p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752302/JAW.

A series of strain controlled low-cycle fatigue tests at 900 deg C in the simulated HTGR helium environment were conducted on Hastelloy X and its modified version, Hastelloy XR, and the effect of strain rate on high-temperature low-cycle fatigue behavior was investigated. The results of this study provide the following conclusions; (1) Decreasing the strain rate led to notable reductions in the fatigue life. (2) Trends of strain softening and cyclic softening were observed at lower strain rates of 1 x 10/sup -4/ s/sup -1/ and 2 x 10/sup -5/ s/sup -1/. (3) Both fracture modes of the transgranular and the intergranular were recognized on the fracture surfaces, with the former mode being predominant at a comparatively high strain rate of 1 x 10/sup -3/ s/sup -1/. The intergranular fracture mode, however, became predominant at lower strain rates, 1 x 10/sup -4/ s/sup -1/ and 2 x 10/sup -5/ s/sup -1/. (4) The cumulative damage rule predicted an excessively coservative value for creep damage. (5) The data obtained lay on the straight line plots when the frequency modified fatigue life method was applied. No significant difference in fatigue behavior was resolved between Hastelloy X and Hastelloy XR under the test conditions employed.

24638 (Juel-Spez—408) Investigations on crack growth in heat exchanging components with working temperatures above 800degC - a contribution to a HTR safety concept (SR 343). Final report. Roedig, M.; Kwasny, R.; Pfaffelhuber, M.; Schubert, F.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe). Jul 1987. 192p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI88752671/JAW.

Experiments on the transferability of fracture mechanics data to thick walled tubes have been performed with the materials X10NiCrAlTi 32 20 (Alloy 800 H) and NiCr 22 Co 12 Mo (Inconel 617). The fatigue crack growth is well described by the linear elastic concept up to the highest testing temperatures (900degC). For the description of the creep crack propagation in tubes the parameter 'energy rate integral' seems to be suitable.

24639 (KFK—4229) Summarizing report on research and development activities in 1986. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). Mar 1987. 54p. (In German). Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Material- und Festkoerperforschung.

The IMF consists of four departments with different task fields. Department IMF I primarily does research on nuclear fuels, fuel pins, thermonuclear reactor fuels and structural ceramics. The activities of Department IMF II are devoted to metallic materials, especially cladding and structural materials, whereas the Department III investigates fuel elements, plutonium technology problems, thermonuclear fertile material and irradiation methods, and the

IMF IV carries out R and D work in the field of component reliability, failure mechanisms, and defect detection. The points of main interest cover all aspects of the development of cladding and structural materials, nuclear fuels and fuel elements for fast breeder reactors, materials problems of relevance to nuclear safety, and problems of the outer fuel cycle, particularly fuel reprocessing and waste management problems. Expanding fields of activity are materials and ultimate tensile strength studies for fusion reactors, and non-project-bound research work on high-duty metallic, ceramic, and polymer materials.

24640 **(KU-HCOE-FL2-R—87-6) High pressure structural study of quasicrystalline Al-Mn.** Johnson, E.; Staun Olsen, J.; Wood, J.V.; Gerward, L. (Copenhagen Univ. (Denmark). Fysisk Lab. 2; Open Univ., Milton Keynes (UK). Dept. of Materials Science; Danmarks Tekniske Hoejskole, Lyngby. Lab. for Applied Physics). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.). 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752688/JAW.

High pressure X-ray diffraction studies have been performed on rapidly solidified Al-Mn alloys (35 and 40 wt% Mn) containing the quasicrystalline phase. Pressure experiments were undertaken using a diamond anvil cell, and X-ray diffraction analysis in the energy dispersive mode was performed using the synchrotron radiation facility at HASYLAB-DESY in Hamburg. Both the quasicrystalline phase and the Al-Mn α phase were found to have stable structures for pressures up to 47 GPa and they showed reversible behaviour for decreasing pressures. Using a Murnaghan type equation of state, the best values of the bulk modulus and its pressure derivative for the icosahedral phase were found to be B/sub 0/ =146 GPa-+10 GPa and B'/sub 0/ = 1.7 -+ 0.5 respectively. The bulk modulus and the pressure derivative for the α phase are B/sub 0/ = 85 GPa -+ 2 GPa and B'/sub 0/ = 2.9 -+ 0.1 respectively.

24641 **(KU-HCOE-FL2-R—87-7) Segregation and structural effects of boron in rapidly solidified copper-boron alloys.** Cookey, R.; Wood, J.V.; Johnson, E.; Henriksen, O.; Johansen, A.; Sarholt-Kristensen, L. (Open Univ., Milton Keynes (UK). Dept. of Materials Science; Copenhagen Univ. (Denmark). Fysisk Lab. 2). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.). 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752689/JAW.

Copper boron alloys with up to 2 wt% B have been melt spun under inert atmosphere conditions. There is evidence of an amorphous zone at the highest boron concentrations near the wheel surface. The remainder of the ribbon displays cellular and dendritic structures indicative of eutectic suppression. This has a considerable effect on the through thickness microhardness with values up to 520 H/sub v/ observed. Nuclear reaction analysis has been used to confirm that the mean boron content across a ribbon is constant. However there are large increases (up to 8 wt%) in the free and wheel surfaces of the ribbon to a depth of 25 nm. These appear to have little influence on the corrosion performance of Cu-B melt spun ribbons in chloride ion solutions.

24642 **(KU-HCOE-FL2-R—87-8) Microstructure of rapidly solidified stainless steels.** Johnson, E.; Graabaek, L.; Johansen, A.; Sarholt-Kristensen, L.; Wood, J.V. (Copenhagen Univ. (Denmark). Fysisk Lab. 2; Open Univ., Milton Keynes (UK). Dept. of Materials Science). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.). 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752690/JAW.

Melt spun ribbons of series of stainless steels (Fe-Cr-Ni-C) alloys have been produced by rapid solidification processing in order to study the influence of this technique on the microstructure and distribution of γ and α phases in the ribbons. Using Moessbauer spectroscopy it has been observed that rapid quenching not only suppresses the martensite start (M/sub s/) temperature, thus stabilising austenite at low Cr concentrations, but that it also inhibits diffusion assisted formation of ferrite at higher Cr concentrations. As a whole, rapid solidification leads to a shift of the austenite minimum in the Schaeffler diagram towards lower Ni and higher Cr concentrations, and at the same time the duplex fields become narrower.

24643 **(LA—11083-MS) Incommensurate/commensurate charge-density-wave states as a source for plutonium metal behavior.** Sandenaw, T.A. (Los Alamos National Lab., NM (USA)). Mar 1988. Contract W-7405-ENG-36. 29p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88007098/JAW.

Plutonium (Pu) metal phases show the general behavior of investigated incommensurate crystals. The space group structure of the alpha phase of Pu (P^2_1/m) is the same as that of proven charge-density-wave (CDW) systems that have a quasi-one-dimensional structure (one-dimensional modulation). The hysteresis in resistivity vs temperature curve of the alpha phase ($P2_1/m$), as well as Hall coefficient response, suggests that this phase has regions of incommensurate and commensurate CDW states. The reported effect of current density and current direction on Hall voltage is added evidence for these states. The incommensurate phases of proven incommensurate crystals have chiral symmetry in at least one dimension (twofold screw axis with a center of symmetry). Space group structures of commensurate phases indicate they are nonchiral. The reported space group structures for all Pu phases, except the gamma, indicate the presence of a screw axis with a center of symmetry in at least one dimension. The reported internal friction and relative shear modulus results can be analyzed to show an apparent confirmation for incommensurate and/or commensurate CDW states in all Pu phases. Four of the designated space group structures for Pu phases are listed in superspace groups in (3 + 1) dimensions. 50 refs., 4 figs., 1 tab.

24644 **(LA-UR—87-2545) Applications of pulsed neutron powder diffraction to actinide elements.** Lawson, A.C.; Richardson, J.W.; Mueller, M.H.; Lander, G.H.; Goldstone, J.A.; Williams, A.; Kwei, G.H.; Von Dreele, R.B.; Faber, J. Jr.; Hitterman, R.L. (Los Alamos National Lab., NM (USA); Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38;W-7405-ENG-36. 12p. (CONF-8708150—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005922/JAW.

From 36. annual Denver X-ray conference; Denver, CO, USA (3 Aug 1987).

We have been using the technique of pulsed neutron powder diffraction to study several problems in the physics and chemistry of the actinide elements. In these elements one often encounters very complex structures resulting from polymorphic transformations presumably induced by the presence of 5f-electrons. For example, at least five distinct structures of plutonium metal are found between room temperature and its melting point of 640°C, and two of the structures are monoclinc. The determination of the crystal structure of beta-uranium (tetragonal, 30 atoms per unit cell) which has finnaly been shown to be centrosymmetric, after decades of uncertainty is discussed. Some preliminary results on the structure of alpha-plutonium (which confirm Zachariasen's original determination of the monoclinic structure) are presented. Pu-Al alloys were also studied. 12 refs., 18 figs.

24645 **(ND-R—1469(D)) Method for measurement of liquid density of plutonium concentrate samples using the Anton Paar calculating digital density meter.** Mair, M.A.; Brown, M.L. (UKAEA Dounreay Nuclear Power Development Establishment). (UKAEA Risley Nuclear Power Development Establishment). Oct 1987. 8p. H.M. Stationery Office, London, price Pound 4.00.

The sample is loaded by suction into the glass U-tube thermostated DMA 46 density meter in such a way as to avoid air bubbles. The sample density is displayed on a 5-figure LED output and is stable after approximately 3 minutes.

24646 **(NOVA—8407) Development of all-position, mechanized and automatic FCAW systems for the fabrication of offshore structures and Arctic vessels. Final report.** Dorling, D.V.; Huntley, R.M.; Rothwell, A.B. (Nova, an Alberta Corp. (Canada)). Jul 1984. 114p. (MICROLOG—85-0549). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

For the economical construction of offshore structures and Arctic vessels, a need exists for welding processes capable of depositing weld metal of high integrity and toughness which offer improved productivity, relative to the conventional shielded metal arc process. This report describes the development of mechanized and automated flux-cored arc welding systems which can be used with conventional d.c. and pulsed power sources of both transformer-rectifier and motor generator type. Three rutile-cored consumables were identified which showed excellent operating characteristics in all welding positions when operated in the d.c. mode, while none of the basic or metal-cored wires was acceptable. In the pulsed mode, these three rutile-cored wires again gave superior results; only one of the basic wires had acceptable operating charcteristics, and presented such limitations that no productivity advantage could be anticipated. For the three rutile wires, however, both d.c. and pulsed-mode procedures were developed. Test panels produced in 25 mm thick Lloyds LT60 plate, using similar procedures, gave encouraging Charpy toughness results (29-54 J at -60/sup 0/C). Further optimization of consumables and/or welding procedure appears necessary in order to achieve toughness properties suitable for extemely severe service conditions.

24647 **(NSTU/MME—9/9117) Transmission electron microscopy of niobium and vanadium carbonitride precipitates in low-alloy eutectoid steels for premium rail. Final report.** Laufer, E.E. (Nova Scotia Technical Univ., Halifax (Canada). Dept. of Mining and Metallurgical Engineering). 28 Apr 1981. 52p. (MICROLOG—82-1551). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Samples of eleven steels were examined to determine whether they contained Nb and/or V carbonitride precipitates. Where significant numbers of precipitates were found, their distributions were determined. The results obtained are tabled according to precipitate size, spacing, and distribution. 36 figs., 5 tabs.

24648 **(NV/IO—82/0086) Review of steels used in the construction of offshore structures.** (Norske Veritas, Oslo (Norway). Industrial and Offshore Div.). 30 Apr 1982. 86p. (MICROLOG—83-0050). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report reviewed requirements for stuctural steel and weldments in mobile and fixed offshore platforms. The review is based on regulatory guidelines. The regulations and rules are compared with current offshore practice as reflected by the company specifications of major operators and by the most referenced industrial standards. Special attention has been given to specifications pertaining to North Sea structures. The implications of imposing the material requirements of present regulations, rules and standard established for temperatures down to -15 to -20/sup 0/C are commented upon. Alternative design solutions or approaches seem to be necessary for lower temperatures.

24649 **(OH—84-57-K) Technical assistance to AECL: electron beam welding of thick-walled copper containers for nuclear fuel waste disposal. Phase two.** Maak, P.Y.Y. (Ontario Hydro Research Lab., Toronto (Canada)). 28 May 1984. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701957/JAW.

This report describes the results of Phase Two of the copper electron beam welding project for the final closure of copper containers for nuclear fuel waste disposal. It has been demonstrated that single pass, electron beam square butt welds (depth of weld penetration $>$ 25 mm) can be made without preheat in both electrolytic tough-pitch copper and oxygen-free copper plates. The present results show that oxygen-free copper exhibits better weldability than the electrolytic tough-pitch copper in terms of weld penetration and vulnerability to weld defects such as gas porosity, erratic metal overflow and blow holes. The results of ultrasonic inspection studies of the welds are also discussed.

24650 **(RFP—4166) Finite element analysis of Hot Isostatic Pressing of beryllium powder into near net shapes.** Courtney, T.P.; Krankota, J.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1987. Contract AC04-76DP03533. 21p. (CONF-8710286—1). NTIS, PC A03. Order Number DE88005337/JAW.

From Shipping and forming committee meeting; Cincinnati, OH, USA (10 Oct 1987).

Hot Isostatic Pressing (HIPing) of beryllium powder into near net shapes is being investigated at Rocky Flats. Powder is produced from a blend of recycled scrap and high-purity, electrorefined flake. One shape of interest is a hemispherical shell which is HIPed from powder in the annulus of a can made from two hemispherical steel shells of different radii welded at the brim. Initial tests resulted in the outer wall buckling during HIPing. Finite Element Analysis (MARC/MENTAT code) was used to construct 2-D axisymmetric models and perform simulations of the process. This large deformation, nonlinear analysis included a constitutive model for the compaction of the powder. Sensitivity studies were made to show the effect of changes in process variables and shape geometries (i.e., wall thickness, shell radius) on the deformation behavior of the powder in the annulus. Results were used to modify can design to produce acceptable parts for finish machining. The analysis confirmed the need to thicken the outer wall to prevent buckling. 10 figs.

24651 **(SAND—87-1218C) Elasto-plastic analysis using a stress-based finite element method and an endochronic theory of plasticity.** Attaway, S.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880438—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003001/JAW.

From International conference on computational engineering science; Atlanta, GA, USA (10 Apr 1988).

A stress-based finite element methodology that uses the endochronic theory to model elasto-plastic structural behavior is presented. The methodology is implemented through a "tangent" stiffness formulation using a discretization of four-fields consisting of: (1) stress, (2) displacement, (3) magnitude of plastic strain, and (4) hydrostatic stress. The four-field approach allows elastically incompressible materials and materials that become incompressible due to plastic flow to be modeled. The stress-based element has been demonstrated to give more accurate solutions for displacements and stresses than conventional displacement models. 6 refs., 4 figs.

24652 **(ST—8500) Determination of the ability of Stelco ingot and strand cast structural plate to meet the mechanical property requirements for Canadian offshore structures and ships. Final report.** McCutcheon, D.B. (Stelco Technology, Hamilton, Ontario (Canada)). 1985. vp. (MICROLOG—85-6078). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This document is a compilation of six research reports all dealing with the design of a steel blend suitable for the construction of offshore platforms exposed to an Arctic environment. Six abstracts have been prepared.

24653 **(UCRL—21021) The thermal radiative properties of metals at high temperature: Annual report to Lawrence Livermore National Laboratory for the period 20 October 1986 to 30 September 1987.** Self, S.A. (Stanford Univ., CA (USA). Dept. of Mechanical Engineering). 1987. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006625/JAW.

The principal aims of this research program are two-fold. The first is to develop apparatus and techniques for the detailed and reliable measurement of the optical constants of molten metals under highly controlled and documented surface conditions. The second is to make such measurements on a number of metals of technical interest to LLNL which will allow reliable radiative heat transfer calculations to be made in several applications of interest to LLNL. Measuring methods of optical properties and remissivity, along with instrument design, are discussed. 2 refs., 6 figs.

24654 Fabrication and structure of Mo/Ta superlattices. Bennett, W.R.; Falco, C.M. (Optical Sciences Center, University of Arizona, Tucson, Arizona 85721). *Journal of Applied Physics;* **63**: No. 6, 2176-2178(15 Mar 1988).

Mo/Ta superlattices with superlattice wavelengths in the range 20—180 A were made by alternately sputtering these components. We present the results of a variety of x-ray diffraction studies used to structurally characterize these samples.

24655 Deuterium interactions with ion-implanted oxygen in aluminum. Myers, S.M.; Follstaedt, D.M. (Sandia National Laboratories, Division 1112, Albuquerque, New Mexico 87185-5800). *Journal of Applied Physics;* **63**: No. 6, 1942-1950(15 Mar 1988). Contract AC04-76DP00789.

The trapping of deuterium (D) by ion-implanted oxygen in aluminum was characterized through temperature-ramp experiments which utilized nuclear-reaction profiling. In the presence of γ-Al_2O_3 precipitates produced by post-implantation annealing at 823 K, two trapping processes were identified: the first, with a binding enthalpy of 0.7 eV relative to D in solution, is attributed to the formation of molecular D_2 at the precipitate boundaries; the second process, which exhibits a range of binding enthalpies above 1 eV, is believed to reflect the formation of chemical bonds at oxide defects. These two trapping effects were also observed in the absence of precipitation annealing, but with different saturation concentrations; their occurrence here may reflect O clustering during the room-temperature implantation of O. It is argued that the trapping mechanisms identified in this work may be widely encountered in metals and alloys containing O, with potentially important technological consequences.

24656 Scanning tunneling microscopy of x-ray optics. Green, M.; Richter, M.; Kortright, J.; Barbee, T.; Carr, R.; Lindau, I. (Department of Applied Physics, Stanford University, Stanford, California 94305). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **6**: No. 2, 428-431(Mar 1988).

Results of scanning tunneling microscope studies of both single-layer and multilayer x-ray reflecting optics are presented. The surface roughness of thin Pt films, Pt with a thin overlayer of Rh, and W/C (C on top) multilayers, all sputter deposited on optical glass flats, was investigated. The use of glass substrates with overall height variation of one-tenth wave rather than one-fifth wave produces no improvement in small-scale surface smoothness (lateral dimensions <1000 A). No evidence of crystallization was seen on any of the samples. Rhodium coated mirrors demonstrated smaller, more uniform features than the irregular hills of Pt. The amorphous C topped multilayers showed atomic scale features and low overall corrugation. rms surface roughness measurements are in excellent agreement with those derived by x-ray techniques. Surface feature size distribution for the Rh/Pt samples has been considered in relation to theories of optical scattering from rough surfaces.

24657 Scanning tunneling microscopy study of the Re(0001) surface passivated by one-half a monolayer of sulfur in an atmospheric environment. Marchon, B.; Ogletree, D.F.; Salmeron, M.; Siekhaus, W. (Material and Chemical Science Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **6**: No. 2, 531-533(Mar 1988). Contract AC03-76SF00098;W-7405-ENG-48.

The Re(0001) surface can be passivated by the adsorption of 50% of a monolayer of sulfur. The structure is ordered as shown by a 2((3)/sup 1/2/ x (3)/sup 1/2/)R30° low-energy electron diffraction pattern. Exposure to air does not modify the surface composition nor the structure. We have obtained STM images of this surface in an atmospheric environment. Large and atomically flat domains have been observed, together with areas composed of multiple steps of various heights. Images of the local barrier height show a significant decrease near the steps, as expected. Higher resolution images recorded in this mode exhibit atomiclike features which are tentatively assigned to sulfur atoms. Short-range order with distances of the order of the superlattice parameter could be detected. No long-range order, however, has been observed.

24658 Grazing incidence X-ray diffraction of lead monolayers at a silver (111) and gold (111) electrode/electrolyte interface. Samant, M.G.; Toney, M.F.; Borges, G.L.; Blum, L.; Melroy, O.R. (IBM Almaden Research Center, San Jose, CA). *Journal of Physical Chemistry;* **220-225**: No. 1, 92(14 Jan 1988).

Using grazing incidence geometry and a thin-layer cell, X-ray scattering has been used to study the structure of electrochemically deposited monolayers of lead on silver (111) and gold (111) electrodes in situ. When deposited on silver, the lead orders in a hexagonal close-packed (hcp) geometry with the lead lattice compressed 1.2% relative to bulk lead. A rotational epitaxy angle of 4.4° was observed. From the width of the first-order diffraction peak, the domain size was determined to be $>$ 150 A, indicating that even immersed in solution, the lead forms a well-ordered two-dimensional solid. On a gold (111) substrate, the lead monolayer was again found to order into a hcp geometry, incommensurate with the gold. The lead layer was compressed 0.7% relative to bulk lead, with a domain size $>$ 100 A.

24659 Aerosol production of molten metals. Watson, L.D. (Idaho National Engineering Lab., EG and G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). pp 1 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Nebulization produces liquid aerosols by the interaction of a gas jet with a liquid stream. This presentation discusses developments and applications of nebulization when the liquid is a molten metal. The various applications for nebulizing liquid metals may require that the droplets be rapidly solidified to a powder, remain liquid or semi solid for deposition on a substrate or be selected by particle size for elemental analysis. All three applications require that attention be paid to droplet size distribution, production rate, efficiency and contamination of the product. Most of these parameters are highly interrelated. This makes a system designed for one application not well suited for another application. The aspiration by the nebulizing gas over the liquid feed tube controls the liquid feed rate. The gas to metal ratio and gas velocity are used to control the particle size distribution. Production rate and efficiency are controlled by liquid stream size and back pressure on the nebulizing system. Construction materials, sealants and the die operating gases are sources of contamination. Contamination control is increasingly difficult with increasing temperature. Two types of nebulization dies were investigated. One with the gas stream orthogonal to the liquid stream and one with the gas stream annular to the liquid stream. The system parameters have different relationships depending on the die used. The advantages and disadvantages of each die are discussed.

24660 Design of low carbon dual phase steels for bars and wire rods. Thomas, G. (Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA 94720 (USA)). pp 147-162 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—).

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Low carbon dual phase steels can be designed of simple compositions to yield products which are highly cold formable. In this paper specific attention is paid to the production of dual phase steel bars and rods and especially to the potential of the latter for wire drawing which does not require patenting heat treatments.

24661 **Martensitic transformation as a deformation process.** Olson, G.B.; Cohen, M. (Massachusetts Institute of Technology, Cambridge, MA 02139 (USA)). pp 367-390 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—).

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Constitutive relations for transformation plasticity have been derived from martensitic transformation kinetic theory, predicting flow-stress as a function of strain, strain-rate, temperature, and stress state. The stress-strain curve can exhibit upward curvature under the combined influence of the softening contribution of the transformation as a deformation mechanism and the hardening contribution of the transformation product. This shape provides a maximum stability of plastic flow and quantitatively accounts for observed enhancement of uniform ductility in TRIP steels. In combination with transformation dilation effects, the flow stabilizing influence also accounts for a major transformation toughening effect observed when ductile fracture is controlled by plastic shear instability. The principles have now been applied to both homogeneous and dispersed-phase alloy systems.

24662 **The FCC to HCP to BCC phase transformation sequence in metastable Fe-Mn-Cr alloys.** Thompson, L.D. (Dept. of Mechanical Engineering, San Diego State Univ., San Diego, CA 92182-0191 (USA)). pp 391-408 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—).

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Phase transformations in metastable austenitic Fe-Mn-Cr alloys are discussed. The FCC to HCP to BCC phase transformation sequence was studied for both the athermal and strain-assisted modes including nucleation events and resultant microstructural features. Mechanical behavior and fracture characteristics are correlated with alloy chemistry, phase stabilities and morphologies in the temperature range of -196 to 23 C. Excellent combinations of strength, ductility, and toughness were observed for the 16Mn-13Cr base alloys. Interstitial alloying element additions were found to decrease the low temperature toughness by promoting cleavage of the HCP phase.

24663 **Fundamentals of fracture and fatigue: A basis for alloy design.** Ritchie, R.O.; Gerberich, W.W.; Antolovich, S.D. (Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA 94720 (USA)). pp 59-98 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—).

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Micro-mechanics and mechanisms describing fundamental aspects of failure by fatigue and fracture are examined from the perspective of alloy design of superior engineering metals and alloys. First, the physical basis for intrinsic fracture toughness in materials is derived through several micro-mechanical models for both brittle and ductile fracture, specifically for cleavage, microvoid coalescence and transitional fracture modes. Second, factors governing the rate of growth of fatigue cracks are described, with emphasis on the role of crack tip shielding mechanisms such as crack closure. Examples of the design of microstructures giving optimum resistance to fatigue crack propagation are presented, with emphasis on high temperature behavior.

24664 **The design of tough ferritic steels for cryogenic use.** Morris, J.W. Jr. (Dept. of Materials Science and Mineral Engineering, and Materials and Molecular Research Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720 (USA)). pp 99-124 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—). Contract AC03-76SF00098.

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

This paper describes the design of ferritic steels and weldments that combine strength and toughness at cryogenic temperatures. The alloy must have a ductile-brittle transition temperature below the intended service temperature and a high fracture toughness in the ductile mode. Its systematic designs uses the microstructure-property relations that govern the transition temperature and fracture toughness to identify a suitable microstructure, and then employs the microstructure-processing relations that govern its thermal response to manipulate the microstructure into the appropriate form. The procedure is illustrated by describing the heat treatments, microstructures and properties of a variety of laboratory and commercial alloys, and the welding procedures and ferritic filler metals that are useful for ferritic cryogenic steels.

24665 **Grain boundary segregation and environmentally induced fracture of materials.** Jones, R.H. (Pacific Northwest Lab., Richland, WA 99352 (USA)). pp 227-250 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—). Contract AC06-76RL01830.

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Segregation of metalloid impurities such as S, P, and Sb to grain boundaries can induce hydrogen embrittlement (HE) and intergranular stress corrosion cracking (IGSCC) of materials. Hydrogen induced intergranular subcritical crack growth is affected by metalloid segregation with a combined impurity-hydrogen effect which follows the embrittling trend for impurity segregation in the absence of hydrogen. In Fe, S is more effective than Sb which is more effective than P. A similar relationship has been demonstrated for Ni. The role of metalloid impurity segregation in IGSCC may differ significantly from HE such that an impurity which has a small effect in HE can have a large effect in IGSCC. Sulfur and P in Ni are examples where this role reversal is observed.

24666 **The design of low alloy steels for thick wall pressure vessels.** Todd, J.A. (Dept. of Materials Science, Univ. of Southern California, Los Angeles, CA 90089-0241 (USA)). pp 475-494 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—).

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

The steels required for second generation coal conversion vessels must be fabricated in section sizes up to 400 mm thick and must withstand chemically hostile environments containing elevated temperature and high pressure hydrogen. Compositonal modifications of 2.25Cr-1Mo and 3Cr-1Mo steels have been developed to provide improved hardenability, strength, impact toughness, creep strength, resistance to hydrogen attack and reduced temper embrittlement susceptibility. The alloy design criteria which were applied to develop a new class of weldable, heavy section pressure vessel steels are reviewed in this paper.

24667 **The effect of material properties on erosion behavior.** Levy, A.V. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720 (USA)). pp 251-270 of Mechanical properties and phase transformation in engineering materials - Earl R. Parker symposium on structure property relationship. Antolovich, S.D.; Ritchie, R.O.; Gerberich, W.W. Warrendale, PA; The Metallurgical Society Inc. (1986). (CONF-860340—). Contract AC03-76SF00098.

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

The relations between measureable properties of ductile metals and their solid particle erosion behavior is discussed. The very high amount and rates of local strain of the surface of an alloy when it is struck by an impacting particle are far above what can be achieved in a mechanical properties test. However, some correlations between erosion rate and measureable properties could be made. For the structural alloys tested, higher ductility resulted in lower erosion rates. Heat treatments which hardened the alloys by lattice deformation mechanisms such as martensite formation had little or no effect on their erosion behavior. Elevated temperature tensile strength did relate to erosion rate. The properties of the oxide scales that formed on steels during combined erosion-corrosion had a major effect on the resulting metal loss.

24668 **Summary abstract: the coadsorption of CO and K on Rh(111): an HREELS, TPD, AES, and LEEd study.** Crowell, J.E.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* 2: No. 2, 881-882(Apr-Jun 1984). Contract AC03-76SF00098.

Alkali metal additives are commonly used to alter the reactivity and selectivity of transition metals that catalyze important chemical reactions. It is thought that by transferring substantial electronic charge to the transition metal substrate, alkali additives increase the electron density at the surface. As a consequence, the chemisorptive properties of these surfaces are modified, resulting in changes in catalyst activity and product distribution. One such reaction catalyzed by several transition metals (e.g., Fe, Ni, Rh, and Ru) that are often altered in activity by alkali additives is the hydrogenation of carbon monoxide. In order to understand the role of the alkali adatoms in promoting this reaction, it is important to elucidate the nature of the interaction between the alkali and the coadsorbed species. Hence, they have combined Auger electron spectroscopy (AES), low-energy electron diffraction (LEED), temperature programmed thermal desorption (TPD), and high resolution electron energy loss spectroscopy (HREELS) in order to determine the effect of potassium on the adsorption of carbon monoxide on the Rh(111) surface.

24669 **Near-threshold fatigue crack propagation: A perspective on the role of crack closure.** Suresh, S.; Ritchie, R.O. (Div. of Engineering, Brown Univ., Providence, RI 02912). pp 227-262 of Fatigue crack growth threshold concepts. Davidson, D.L.; Suresh, S. Warrendale, PA; The Metallurgical Society Inc. (1984). (CONF-8310205—).

From TMS-AIME fall meeting/ASM metals congress; Philadelphia, PA, USA (2 Oct 1983).

In recent years, mechanistic and continuum studies on fatigue crack propagation, particularly at near-threshold levels, have highlighted a dominant role of crack closure in influencing growth rate behavior. In this paper the authors review and model the various sources of closure induced by cyclic plasticity, corrosion deposits, irregular fracture morphologies, viscous fluids and metallurgical phase transformations. It is shown that many of the commonly observed effects of mechanical factors, such as load ratio, microstructural factors, such as strength and grain size, and certain environmental conditions can be traced to the extrinsic influence of closure in modifying the effective driving force for crack extension. The implications of such closure mechanisms are discussed in the light of constant and variable amplitude fatigue behavior, the existence of a threshold stress intensity for no fatigue crack growth and the validity of such threshold concepts for the case of short fatigue cracks.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 24081, 24361, 24602, 24639, 24688, 24701

24670 **(CONF-870793—5) Core structure of CSL [coincident-site-lattice] boundaries in NiO.** Merkle, K.L.; Reddy, J.F.; Wiley, C.L.; Smith, D.J. (Argonne National Lab., IL (USA); Arizona State Univ., Tempe (USA). Center for Solid State Science). Oct 1987. Contract W-31109-ENG-38. 8p. (IS—3646). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006009/JAW.

From Conference on interface science and engineering; Lake Placid, NY, USA (12 Jul 1987).

Atomic resolution electron microscopy is used to study <001> CSL (coincident-site-lattice) tilt boundaries in NiO. Asymmetric as well as symmetric grain-boundary plane orientations are found in bicrystals grown by the Verneuil technique. The $\Sigma = 5$, (310) grain boundary is observed to occur in two distinct forms, both of which differ from previously proposed theoretical models. The $\Sigma = 13$, (510) boundary, in addition to also showing a multiplicity of structures, is not planar on an atomic scale, but includes displacements of structural units normal to the average grain-boundary plane. It is suggested that the reduced atomic density at high-purity ceramic-oxide grain boundaries is not only due to lattice expansion, but is in part due to a high concentration of Schottky pairs in the grain boundary. 11 refs., 8 figs.

24671 **(CONF-870843—9) The elastic properties of monoclinic ZrO_2.** Nevitt, M.V.; Chan, S.K.; Liu, J.Z.; Grimsditch, M.H.; Fang, Y. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005920/JAW.

From International conference on electronic structure in phase stability in advanced ceramics; Argonne, IL, USA (17 Aug 1987).

Ultrasonic and Brillouin scattering measurements at ambient temperature have been made on small single crystals of monoclinic ZrO_2. Various features of the angular anisotropy in the acoustic longitudinal wave and shear wave velocities were established, and the elastic stiffness and compliance moduli were computed. Shallow minima in the transverse shear wave velocity in directions parallel to the a and c crystallographic axes were observed. We anticipate that acoustic shear wave softening will be observed in these directions when measurements are made at temperatures close to the monoclinic-tetragonal transformation. 5 refs., 2 figs., 1 tab.

24672 **(CONF-870843—10) Stability limits in the monoclinic-tetragonal transformations of zirconia.** Garvie, R.C.; Chan, S.K. (Commonwealth Scientific and Industrial Research Organization, Clayton (Australia). Div. of Materials Science and Technology; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005924/JAW.

From International conference on electronic structure in phase stability in advanced ceramics; Argonne, IL, USA (17 Aug 1987).

A variety of experimental data obtained from single crystals and powders of zirconia has been examined to obtain the stability limits of the tetragonal and monoclinic phases. These limits are used to delineate the possible modes of transformation at different temperatures in the light of a nonclassical theory of nucleation. The theory predicts an asymmetric relation between three critical temperatures T*, T/sub o/, and T/sub c/. Transformation by nucleation and growth occurs only in the range T/sub o/-T/sub c/ during cooling and in the range T*-T/sub o/ during heating. Below T/sub c/, transformation proceeds homogeneously in a manner akin to spinodal decomposition. In the neighborhood of T/sub c/, the metastable tetragonal phase can have a long lifetime. It is assumed that the driving mechanism of transformation comes from the partial softening of a particular shear mode of lattice vibration. An indirect evidence in support of this assumption comes from the linear relationship between the transformation temperature of a zirconia/hafnia solid solution and the reciprocal effective cation mass. 31 refs., 6 figs.

24673 **(CONF-871124—87) Defect structures in YBa_2Cu_3O/sub 7-x/ produced by electron irradiation.** Kirk, M.A.; Baker, M.C.; Liu, J.Z.; Lam, D.J.; Weber, H.W. (Argonne National Lab., IL (USA); Atominstitut der Oesterreichischen Universitaeten, Vienna). Dec 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005981/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Defect structures in YBa_2Cu_3O/sub 7-x/ produced by electron irradiation at 300° K were investigated by transmission electron microscopy. Threshold energies for the production of visible defects were determined to be 152 keV and 131 keV (+- 7 keV) in directions near the a and b (b > a) axes (both perpendicular to c, the long axis in the orthorhombic structure), respectively. During above threshold irradiations in an electron flux of 3×10^{18} cm^{-2} s^{-1}, extended defects were observed to form and grow to sizes of 10 to 50 nm over 1000 s in material thicknesses 20 to 200 nm. Such low electron threshold energies suggest oxygen atom displacements with recoil energies near 20 eV. The observation of movement of twin boundaries during irradiation just above threshold suggests movement of the basal plane oxygen atoms by direct displacement or defect migration processes. Crystals irradiated above threshold were observed after about 24 hours to have transformed to a structure heavily faulted on planes perpendicular to the c axis. 3 refs., 3 figs.

24674 **(CONF-871126—11) Effective electron interactions due to virtual charge and spin excitations in an extended Hubbard model for Cu-O superconductors.** Schuettler, H.B.; Fedro, A.J. (Georgia Univ., Athens (USA). Dept. of Physics and Astronomy; Northern Illinois Univ., Dekalb (USA); Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02. Order Number DE88005971/JAW.

From 32. conference on magnetism and magnetic materials; Chicago, IL, USA (9 Nov 1987).

We have studied the effect of virtual Cu-O charge and spin fluctuations in the perovskite high-T/sub c/ materials by applying a strong coupling expansion to an extended Hubbard model with hybridized Cu d-orbitals and O p-orbitals. Results for the charge and spin fluctuation-mediated effective interactions are derived and discussed. 8 refs.

24675 **(CONF-8704270—1) Ultrasonic characterization of ceramic joints.** Simpson, W.A. Jr.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005844/JAW.

From International forum on joining of structural ceramics; Pittsburgh, PA, USA (26 Apr 1987).

We describe the development of ultrasonic techniques for the characterization of cermic joints, including the ability to determine which face of a 50-μm-thick layer of braze filler metal is unbonded, thus providing information about the integreity of the ceramic-filler metal bond. We also describe the development of a rapid technique using Lamb waves to probe the bond between alumina coupons in flexature-strength specimens, which geometry makes conventional ultrasonic evaluation of the bond difficult. Also described are techniques for the detection of cracking under sessile drops on alumina disks and the determination of the extent and profile of cracks produced in the bond of flexture-strength specimens subjected to three-point bending. 3 refs., 13 figs.

24676 **(CONF-8711114—5) Thermochemistry and high temperature thermodynamic properties of rare earth-alkaline earth-copper oxide superconductors.** Morss, L.R.; Sonnenberger, D.C.; Thorn, R.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88005976/JAW.

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

Enthalpies of formation of the perovskite-related oxides, La_3CuO_4, La/sub 1.85/Sr/sub 0.15/CuO_4, YBa_2Cu_3O/sub y/, with y = 6.93, 6.62, and 6.41 have been determined at 298.15 K by perchloric acid solution calorimetry. Enthalpies of formation and reaction with air have been evaluated. The partial molar enthalpy of solution of oxygen in YBa_2Cu_3O/sub y/ has been determined and compared with the value derived from measurements of the equilibrium parital vapor pressures of oxygen. The significance of the defect state thermochemistry in conductivity is identified. 1 tab.

24677 **(DOE/ER/13560—2) Investigation of laser diagnostics of PACVD processes for depositing hard face coatings: Performance report for the period 1 February 1987-31 January 1988.** Roman, W.C. (United Technologies Research Center, East Hartford, CT (USA)). Feb 1988. Contract FG02-86ER13560. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88007083/JAW.

Objective is to improve the understanding of the mechanisms which govern the nonequilibrium reactive plasma atomistic or molecular deposition of hard face coatings for erosion resistant applications. The goal is to provide a predictive capability that is severely lacking in the present science base of PACVD processing for depositing hard face coatings. Advanced laser diagnostics will be used to probe the plasma for improving process control.

24678 **(EGG-M—06086) Fracture toughness of silicon nitride-silicon nitride joints bonded with oxynitride glass.** Coon, D.N.; Neilson, R.M. Jr.; Mittl, J.C.; Tallman, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 30p. (CONF-8704271—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005548/JAW.

From Annual meeting of the American Ceramic Society; Chicago, IL, USA (29 Apr 1987).

An investigation into the feasibility of using oxynitride glass as the bonding material to join silicon nitride was undertaken. Two characteristics of these glasses were the basis for their selection. First, their compatibility with silicon nitride as evidenced by their existence as a grain boundary phase. Second, property changes with nitrogen additions suggest higher temperature capabilities with respect to oxide glass. This communication reports the room temperature fracture toughness of silicon nitride joined with oxynitride glass. 10 refs., 12 figs., 5 tabs.

24679 **(LA-UR—88-569) Ordered structures in YBa_2Cu_3O/sub 7-y/, La/sub 2-x/Sr/sub x/CuO/sub 4-∂/ and related perovskites.** Mitchell, T.E.; Roy, T.; Fisk, Z.; Smith, J.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880481—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006461/JAW.

From MRS high temperature superconductors; Reno, NV, USA (4 Apr 1988).

Electron microscopy and electron diffraction studies have been performed on the superconducting oxides YBa_2Cu_3O/sub 7-y/, $GdBa_2Cu_3O$/sub 7-y/ and La/sub 2-x/Sr/sub x/CuO/sub 4-∂/ as well as the related perovskites La_2CuO_4, Eu_2CuO_4 and Gd_2CuO_4. Extra reflections are commonly observed in all the cases. For example, in the 123 compounds, in situ heating leads to transformations from orthorhombic to tetragonal with a loss of twin structure; on cooling the oxygen vacancies re-order in the basal plane to give 1/3(100)* or 1/4(110)* diffraction spots. In tetragonal Eu_2CuO_4 and Gd_2CuO_4, the [001] diffraction patterns often have extra spots at 1/2(110)* or at 1/4(110)* positions. Extra spots are also observed in La_2CuO_4 (orthorhombic) but this is probably due to the space group being primitive rather than centered. These observations are discussed in terms of the ordering of oxygen vacancies in the Cu-O planes of the various perovskite structures. 6 figs.

24680 **(ORF/GC—801231) Development of abrasion resistant ceramics. Final report.** Baranyi, A.D. (Ontario Research Foundation, Mississauga (Canada). Dept. of Glass and Ceramics). 31 Dec 1980. 48p. (MICROLOG—82-1539). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The effect of polymorphic transformations on abrasion resistance in ceramics and ceramic/glass composites was investigated. The literature on the subject was reviewed and a number of possible candidate materials were proposed. Several polymorphs of silica

were mixed with various types of commercial silicate glasses and relative abrasion strengths were measured. A composite containing 90 wt% lead silicate glass and 10 wt% quartz showed a significant improvement in abrasion resistance when compared to the pure lead silicate glass. A new method for the determination of the relative abrasion resistance of ceramic and glass samples was developed for the program. The results indicate that ceramics can be added to glassy matrices which will improve the abrasion resistance of the matrices.

24681 **(SAND—87-1503C) Structure of sol-gel silica.** Brinker, C.J.; Brow, R.K.; Tallant, D.R.; Kirkpatrick, R.J. (Sandia National Labs., Albuquerque, NM (USA); Illinois Univ., Urbana (USA). Dept. of Geology). 1987. Contract AC04-76DP00789. 6p. (CONF-871124—93). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006870/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Combined Raman, ^{29}Si NMR and reactivity studies of silica gels indicate that dehydroxylation of the silica surface results in cyclotrisiloxane species with reduced Si-O-Si bond angles and altered acid/base characteristics. XPS experiments indicate that the expected 0.35 eV shifts in Si2p and O1s binding energies due to the reduced bond angles are hidden within broad peaks due to the remaining hydroxyls. Additional Si2P, O1s, and C1s peaks are also observed and are postulated to result from preferential adsorption of extrinsic C-containing species on sites with enhanced acid/base properties. 21 refs., 5 figs.

24682 **(UCRL—97399) Oxide optical coatings prepared by metal-organic vapor deposition.** Brusasco, R. (Lawrence Livermore National Lab., CA (USA)). 26 Jan 1988. Contract W-7405-ENG-48. 17p. (CONF-8710165—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006809/JAW.

From Boulder damage symposium; Boulder, CO, USA (26 Oct 1987).

We prepared films of alumina, zirconia and hafnia by chemical vapor deposition (CVD) for evaluation as high refractive index optical components for high power laser applications. Films with high index of refraction (1.89 to 1.63) but with rather low single shot laser damage thresholds (4 to 10 J/cm^{-2}) were prepared by high temperature (400°C) thermal decomposition. Lower temperature deposition with chemical assist improves some optical properties and laser damage thresholds at the expense of a lower index of refraction. 6 figs., 4 tabs.

24683 **Band structure of metallic pyrochlore ruthenates $Bi_2Ru_2O_7$ and Pb_2Ru_2O/sub 6.5/.** Hsu, W.Y.; Kasowski, R.V.; Miller, T.; Chiang, T. (Central Research and Development Department, E. I. du Pont de Nemours and Company, Experimental Station, Wilmington, Delaware 19898). *Applied Physics Letters;* **52**: No. 10, 792-794(7 Mar 1988).

The band structure of $Bi_2Ru_2O_7$ and Pb_2Ru_2O/sub 6.5/ has been computed self-consistently from first principles for the first time by the pseudofunction method. We discover that the 6s bands of Bi and Pb are very deep and unlikely to contribute to the metallic behavior as previously believed. The unoccupied 6p bands, however, are only several eV above the Fermi energy and are mixed with the Ru 4d band at the Fermi surface via the framework O atoms, leading to band conduction and delocalized magnetic moments. The predicted location of the 6s bands and the location and width of the O 2p band are confirmed by synchrotron radiation and ultraviolet electron spectroscopy of single crystals.

24684 **Long-range correlations in the two-dimensional spin-(1/2 antiferromagnetic Heisenberg model: A quantum Monte Carlo study.** Manousakis, E.; Salvador, R. (Supercomputer Computations Research Institute, Florida State University, Tallahassee, Florida 32306). *Physical Review Letters;* **60**: No. 9, 840-843(29 Feb 1988).

Using an extended version of Handscomb's Monte Carlo method we study the spin-(1/2 quantum antiferromagnetic Heisenberg model on square lattices of various sizes. The calculated correlation length associated with antiferromagnetic order grows very rapidly as the temperature is lowered suggesting an essential singularity. Our results are consistent with those recently observed by neutron scattering done on La_2CuO_4.

24685 **Comment on "Resistivity of La/sub 1.825/Sr/sub 0.175/CuO_4 and $YBa_2Cu_3O_7$ to 1100 K: Absence of saturation and its implications".** Chen, C. (Ames LaboratoryU.S. Department of Education and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review Letters;* **60**: No. 8, 750-750(22 Feb 1988). Contract W-7405-ENG-82.

A Comment on the Letter by M. Gurvitch and A. T. Fiory, Phys. Rev. Lett. 59, 1337 (1987).

3606 Other Materials

REFER ALSO TO CITATION(S) 24081, 24179, 24198, 24354, 24632, 24678, 24680, 24911, 24931, 24932, 24973, 25491, 25605

24686 **(ANL/ACL—87-1) A study of the permeability of polyethylene pipe by organic compounds.** Schneider, J.F.; Harty, L. (Argonne National Lab., IL (USA)). Dec 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006638/JAW.

A study was made of the permeability of polyethylene pipe by organic solvents and compounds. Samples of pipe from medium- to high-density polyethylene were exposed for 24 hours to organic solvents and compounds in solution. Permeability was determined by extracting the exposed samples with dichloromethane and analyzing the extracts by gas chromatography. The results indicate that permeability is reproducibly measurable by this method. 2 figs., 2 tabs.

24687 **(CANMET—850107) Accelerated testing of concrete durability exposed to a marine environment.** Celovsky, A.L.; Waugh, L.M.; Morris, D.R.; Bremner, T.W. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 7 Jan 1985. 191p. (MICROLOG—85-5919). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report describes the developemnt of an apparatus for the accelerated study of the durability of concrete which is exposed to a simulated marine environment. The test consists of a six-hour cycle (four cycles per day) of alternate wetting and hot air drying. Measurements, which included visual inspection, weight, density, volume, resonant frequency, velocity of sound, and corrosion potential, were recoded for specimens from three different mixes. After 975 cycles the responses of different mixes were easly distinguished. The results from the accelerated durability than was previously possible. 39 figs., 22 tabs.

24688 **(CONF-871189—2) Superplastic flow of mullite-zirconia composites.** Yoon, C.K.; Chen, I-Wei. (Michigan Univ., Ann Arbor (USA). Dept. of Materials Science and Engineering). 1987. Contract FG02-87ER45302. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005905/JAW.

From 1. international workshop on mullite; Tokyo, Japan (9 Nov 1987).

Mullite-zirconia composites containing up to 50 vol%/o mullite have been superplastically deformed to large strains at relatively low temperatures and stresses. These composites can be sintered at 1400°C and have very fine grain sizes. At 1350°C, the flow stress of a composite containing 50 vol%/o mullite was 62 MPa at a strain rate of 0.001/s. The strain rate sensitivity is higher than 0.6 in the regime 2 and the grain size sensitivity is 3. The mullite grains behave like hard inclusions in a superplastic Y-TZP matrix. While a threshold stress was found at lower strain rates in regime 1, regime 3 behavior was not apparent up to the highest strain rate tested of 0.007/s. 8 figs.

24689 **(EGG-M—02087) Microplasticity phenomena in graphite/magnesium metal matrix composites.** Epstein, J.S.; Rawal, S.; Misra, M. (EG and G Idaho, Inc., Idaho Falls (USA); Martin Marietta Aerospace, Denver, CO (USA)). 1987. Contract AC07-76ID01570. 7p. (CONF-8708213—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006772/JAW.

From SPIE international conference on photomechanics; San Diego, CA, USA (21 Aug 1987).

This paper discusses localized matrix plasticity in a Pitch 55 graphite/magnesium (Gr/Mg) metal matrix composite (MMC) due to damping/hysteresis effects in bending. It was found that for this material system, chosen mainly for its damping ability, plasticity or permanent deformation occurs in the matrix material of the composite from relatively small structural deformations. Hysteresis loops were determined on a local level in the diffusion bond region between adjacent graphite fiber bundles as well as on the free edge of the magnesium face sheet of the composite. Moire interferometry was combined with research on the microstructure of this particular material system to yield these subtle results.

24690 **(IC—87/136) On the possibility of the soliton description of acoustic emission during plastic deformation of crystals.** Pawelek, A. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701878/JAW.

Two basic sources of acoustic emission (AE) during plastic deformation of pure crystals are discussed. One is related to non-stationary dislocation motion (the bremsstrahlung type of acoustic radiation), and the other to dislocation annihilation processes (the main component of the transition type of acoustic radiation). The possible soliton description of the bremsstrahlung acoustic radiation by oscillating dislocation kink and by bound kink-antikink pair (dislocation breather) is cosidered on the basis of Eshelby's theory (Proc. Roy. Soc. London A266, 222 (1962)). The dislocation annihilation component of transition acoustic emission is considered only in relation to the Frank-Read source operation. A soliton model for this type of acoustic radiation is proposed and the simple quantum-mechanical hypothesis is advanced for the purpose. Both soliton descriptions are discussed on the basis of available experimental data on the AE intensity behaviour during tensile deformation of crystals. (author). 36 refs, 5 figs.

24691 **(IC—87/139) Derivation of space groups in mm2, 222 and mmm crystal classes.** Nigam, G.D. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1987. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701881/JAW.

An algebraic approach is developed to derive space groups using 4x4 Seitz matrices for the crystal classes mm2, 222 and mmm in the orthorhombic system. The advantage of the present method is that it is relatively simple and can be adapted to introduce space groups to beginners. One of the advantages of the present method is that it admits a geometrical visualization of the symmetry elements of space group. The method can easily be extended to other crystal classes in a straightforward way. 16 refs, 1 fig., 2 tabs.

24692 **(IC—87/144) Nonlinear effects in low-dimensional magnetism: Solitons and vortices.** Bishop, A.R.; Kawabata, C.; Mertens, F.G.; Wysin, G.M. (International Centre for Theoretical Physics, Trieste (Italy); Okayama Univ. Computing Centre (Japan); Bayreuth Univ. (Germany, F.R.); Los Alamos National Lab., NM (USA)). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701886/JAW.

The report outlines recent results on the dynamics of easy-plane classical ferromagnetic spin in two spatial dimensions emphasising possible signatures of unbound vortices above the Kosterlitz-Thouless topological phase transition. 18 refs, 1 fig.

24693 **(INIS-mf—11612) Contribution on the calculation of composite structures using orthogonal residual stress distributions.** Beisel, T. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bauingenieur- und Vermessungswesen). 26 Mar 1985. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752030/JAW.

A new method for the analysis of creep and shrinkage effects of concrete in composite beams is presented. With this method the time dependent change of the stress distribution over the cross section is calculated by using new definitions of 'orthogonal residual stress distributions' and 'stress resultants' of these distributions. The time dependency is introduced by the algebraic constitutive law formulated by TROST. Examples are given to demonstrate the application of the new method for statically determined and indetermined structures, as well as for beams with rigid or flexible shear joints between the concrete and the steel parts in the composite section.

24694 **(INIS-mf—11627) Structure and the electronic energy levels of point defects and their interaction with dislocations in CdTe.** Zoth, G. (Goettingen Univ. (Germany, F.R.). Fachbereich Physik). 7 Feb 1986. 118p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752248/JAW.

The aim of the present thesis is the investigation of deep trapping centers in p-type CdTe crystals by means of capacitance measurements. Special emphasis is layed on the energy levels in the energy gap, which correlate with dislocations. In chapter 3 the primary material is investigated, Cu was found to be the major impurity in the crystals. Then (chapter 4) changes after heat treatments in Te atmosphere are discussed; the new trapping centers are characterized and diffusion processes are outlined (chapter 5). Chapter 6 deals with the influence of plastic deformation on deep centers. (BHO).

24695 **(LA-UR—88-415) Solid hosts for dye laser rods: Part 2, Some experimental results.** Erickson, G.F. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 8p. (CONF-871254—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006471/JAW.

From Lasers '87; Lake Tahoe, NV, USA (7 Dec 1987).

Attempts and problems encountered in producing high quality polymer dye laser rods are discussed. Purification methods used on the monomer materials, curing agent problems, and gamma radiation curing are considered. 7 figs.

24696 **(LBL—23599) Absolute pressure derivatives of deep level defects in III-V semiconductors.** Nolte, D.D.; Walukiewicz, W.; Haller, E.E. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA)). Nov 1987. Contract AC03-76SF00098. 8p. (CONF-871124—80). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006318/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Based on transition metal reference levels, we present absolute pressure derivatives for band-edges in GaAs and InP and defects in GaAs. The defect deformation potentials are directly related to the electron-lattice coupling which drives lattice relaxation around the defects. We find an exceedingly large inward lattice relaxation of the EL2 defect in GaAs upon electron emission. 12 refs., 1 fig.

24697 **(LBL—24467) First-principles calculations of quasiparticle energies at surfaces and interfaces: Semiconductor surface-state spectra and band offsets.** Louie, S.G. (Lawrence Berkeley Lab., CA (USA)). Dec 1987. Contract AC03-76SF00098. 7p. (CONF-871266—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006340/JAW.

From Solvay conference on surface science; Austin, TX, USA (14 Dec 1987).

The first-principles theory for calculating surface-state energies and semiconductor band offsets is described. Within a quasiparticle interpretation of excitation spectra, the approach provides

well-founded energies which can be compared directly with sepctroscopy measurements. Results for the As-capped Si(111) and Ge(111) surfaces and for the GaAs-AlAs(001) heterojunction are discussed and compared with experiment. 14 refs., 3 figs.

24698 **(SAND—88-0092C) Buried layer tungsten deposits in porous silicon: Metal penetration depth and film purity determinants.** Blewer, R.S.; Tsao, S.S.; Gutierrez, G.M. (Sandia National Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA). Dept. of Electrical Engineering). 1987. Contract AC04-76DP00789. 7p. (CONF-8711161—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006104/JAW.

From MRS silicon-on-insulator and buried metals in semiconductors conference; Boston, MA, USA (30 Nov 1987).

Infiltration of anodically prepared porous silicon with tungsten hexafluoride gas has been investigated as a function of silicon porosity, source gas pressure and carrier gas type and flow rate. The depth of tungsten metallization in the silicon has been shown to depend most sensitively on the WF_6 partial pressure, and less on the flow rate and carrier gas type. Penetration depths of >30 μm have been attained. Structural integrity of the tungsten layer is dependent on the porosity of the starting material and the degree of internal oxidation of the porous silicon surface area. 6 refs., 8 figs.

24699 **(UCRL—15991) The reaction of glass in a gamma irradiated saturated tuff environment: Part 2, Data package for ATM-1c and ATM-8 glasses.** Bates, J.K.; Gerding, T.J.; Fischer, D.F.; Ebert, W.L. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 131p. (SANL—610-008-11/87). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88006239/JAW.

A series of experiments have been performed in support of the Nevada Nuclear Waste Storage Investigations (NNWSI) project that investigate the efects of gamma radiation on groundwater and glass reaction. Experiments have been done in a gamma radiation field at exposure rates ranging between 2×10^5 and 0 R/h, and have been performed over a period of four years. All the data that have been generated during these experiments and which were used in writing the article are presented. The report consists of a series of Tables that provide the (1) groundwater compositions; (2) glass compositions; (3) experimental matrices and selected results; (4) cation analyses; (5) anion analyses; (6) Np and Pu analyses; (7) SEM/EDS analyses; and (8) SIMS analyses exposure rates of 2×10^5 (2R), 1×10^3 (1R), and 0 (OR) R/h. 2 refs., 7 figs., 16 tabs.

24700 **(UCRL—21016) Dispersion of non-oxide particulates: Final technical report.** Aksay, I.A. (Washington Univ., Seattle (USA). Dept. of Materials Science and Engineering). 26 Oct 1987. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006624/JAW.

Suitable surfactants to aid consolidation of ceramic and metal powders in nonaqueous solvents were evaluated. Evidence is presented that lubricating surfactants can reduce the interparticle forces between particles enough to allow dense consolidation without colloidal stability. A fluorinated polymer was discovered to promote dense consolidation irrespective of solvent or stability. This unique phenomena is explored. The chemistry, adsorption, and bonding for this fluorinated polymer is examined. Research is directed so that an understanding of this model system may be extended to the development of future processing additives.

24701 **(UCRL—96109) Optical characterization of microcrystals.** Davis, L.; Eimerl, D.; Velsko, S. (Lawrence Berkeley Lab., CA (USA)). 10 Dec 1987. Contract W-7405-ENG-48. 23p. (CONF-870799—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006622/JAW.

From American conference on crystal growth; Monterey, CA, USA (13 Jul 1987).

A new method to optical characterization of microcrystals is described and illustrated with experimental results. Techniques for characterizing the linear and nonlinear parameters of new materials at early stages of crystal growth have been developed. The linear indices of refraction and their dispersion are determined using combined methods of spindle stage microscopy and refractometry. This method has been extended to measurements at nonvisible wavelengths. An SHG apparatus of novel design is used to evaluate the overall nonlinearity. Both methods are used to study materials with single crystal domains as small as 50 μm. 14 refs., 7 figs., 2 tabs.

24702 **(UCRL—96861) The combustion synthesis of boride composites.** Halverson, D.C.; Lum, B.Y.; Munir, Z.A. (Lawrence Livermore National Lab., CA (USA); California Univ., Davis (USA)). Oct 1987. Contract W-7405-ENG-48. 11p. (CONF-8710216—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005474/JAW.

From Symposium on high-temperature materials chemistry; Honolulu, HI, USA (18 Oct 1987).

We have investigated the combustion synthesis process as a means of producing hard, tough, lightweight B_4C/TiB_2 composites. We based our experimental program on thermodynamic calculations. Adiabatic temperatures and product compositions were determined on the basis of the stoichiometry and initial temperature of the reactants. For lightweight products the composition must be relatively rich in the B_4C component. We found that B_4C-rich composites could only be obtained by increasing the initial temperature of the reactants. The product is a hard, porous material whose toughness should be enhanced by filling the pores with aluminum using a liquid-metal infiltration process. 9 figs., 3 tabs.

24703 **Neutral radical deposition from silane discharges.** Gallagher, A. (Joint Institute for Laboratory Astrophysics, National Bureau of Standards and University of Colorado, Boulder, Colorado 80309-0440). *Journal of Applied Physics;* **63**: No. 7, 2406-2413(1 Apr 1988).

The fractional contributions of the various SiH/sub n/ radicals (n = 0—3) to deposition are calculated for low-power, pure-silane rf and dc discharges. This is done using a radical diffusion plus reaction equation, combined with current knowledge of SiH_4 dissociation fractionation, of SiH/sub n/+SiH_4 reactions, and of the distributed source of radicals. The conclusion reached is that more than 98% of neutral radical deposition is by SiH_3 for typical deposition pressures (>100 mT at 240 °C). The effect of SiH_3+SiH_3 reactions at higher power is also evaluated using an estimated reaction rate coefficient (k_3). The resulting loss in deposition rate is given as a function of film growth rate and of k_3.

24704 **Small angle scattering of bicontinuous structures in microemulsions.** Vonk, C.G.; Billman, J.F.; Kaler, E.W. (Department of Chemical Engineering, BF-10, University of Washington, Seattle, Washington 98195). *Journal of Chemical Physics;* **88**: No. 6, 3970-3975(15 Mar 1988).

We present a model of bicontinuous microemulsion structure based on a disordered lamellar structure. The scattering predicted by this model is compared with measured small angle neutron scattering curves from a family of microemulsions formed with sodium 4-(1'-heptylnonyl) benzenesulfonate, iso-butanol, D_2O brines, and the even alkanes from octane to hexadecane. The model, with two parameters, fits the data on an absolute scale well. Disordered lamellae spacings and distortion lengths vary from approximately 850 and 570 A, respectively, for microemulsions formed with dodecane to 430 and 400 A for those formed with hexadecane. A distribution of lamellae thicknesses can be introduced to account for scattering curves that display a maximum in intensity scattered at zero scattering vector.

24705 **Orientation of Langmuir—Blodgett monolayers using NEXAFS.** Outka, D.A.; Stoehr, J.; Rabe, J.P.; Swalen, J.D. (IBM Almaden Research Center, San Jose, California 95120-6099). *Journal of Chemical Physics;* **88**: No. 6, 4076-4087(15 Mar 1988).

Carbon K-shell NEXAFS (near edge x-ray absorption fine structure)= spectra of oriented hydrocarbon chains in Langmuir—Blodgett (LB) monolayers were measured and used to study the orientation of these molecules. The LB monolayers were assembled from arachidic acid or cadmium or calcium arachidate on the oxidized Si(111) surface. The observed NEXAFS resonances are assigned to transitions to excited states which are localized on individual CH_2 groups or C—C bonds. From a detailed analysis using curve-fitting techniques of the angular dependence of the various

spectral peaks, the hydrocarbon chains of the cadmium arachidate monolayer is estimated to lie within 15° of the surface normal, the hydrocarbon chains of the calcium arachidate monolayer is estimated to be tilted by 33 +- 5° from the surface normal, while the arachidic acid monolayer is not ordered at all. The determined chain orientations are discussed in terms of a microscopic model involving lateral interactions between the zig—zag hydrocarbon chains.

24706 **Laser-induced bulk damage in potassium dihydrogen phosphate crystal.** Singleton, M.F.; Cooper, J.F.; Andresen, B.D.; Milanovich, F.P. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Applied Physics Letters;* **52**: No. 11, 857-859(14 Mar 1988).

Potassium dihydrogen phosphate (KDP) is widely used for high-power laser frequency conversion. Its applications, however, are limited by a characteristically low laser damage threshold. This damage is associated with extrinsic impurity inclusions, whose exact nature has not been previously identified. We have now demonstrated that KDP grown in solutions containing organic impurities incorporates select organic compounds into the crystal matrix. Furthermore, we have observed a strong correlation between the concentration of these compounds and the crystal laser damage threshold and density.

24707 **Chemically etched micromirrors in silicon.** Kendall, D.L.; de Guel, G.R.; Guel-Sandoval, S.; Garcia, E.J.; Allen, T.A. (University of New Mexico, Center for High Technology Materials, Albuquerque, New Mexico 87131). *Applied Physics Letters;* **52**: No. 10, 836-837(7 Mar 1988).

Purposely introduced pinholes can be processed so as to produce nearly spherical or paraboloidal depressions in (100) silicon by a two-step chemical etching procedure in KOH:water solutions. Regular arrays of f/1—f/10 specularly reflecting micromirrors can be fabricated.

24708 **Extended infrared response of InAsSb strained-layer superlattices.** Kurtz, S.R.; Osbourn, G.C.; Biefeld, R.M.; Dawson, L.R.; Stein, H.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **52**: No. 10, 831-833(7 Mar 1988). Contract AC04-76DP00789.

Strained-layer superlattices of InAsSb were grown with low densities of dislocations and microcracks for optical characterization to determine the suitability of these structures for infrared photodetectors. Infrared transmission measurements revealed absorption throughout the 8—12 μm region and extended to longer wavelengths than predicted from consideration of the tensile strain-induced band-gap shift in a type-I superlattice. We conclude that a type-II superlattice occurs in the InAsSb system for alloy compositions >60% Sb.

24709 **Scanning tunneling microscopy of silver, gold, and aluminum monomers and small clusters on graphite.** Ganz, E.; Sattler, K.; Clarke, J. (Physics Department, University of California, Berkeley, California 94720 and Center for Advanced Materials, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **6**: No. 2, 419-423(Mar 1988). Contract AC03-76SF00098.

We have deposited small numbers of atoms of silver, gold, and aluminum onto cleaved graphite substrates in ultrahigh vacuum. Using a scanning tunneling microscope, we have observed monomers, groups of monomers, dimers, and a trimer. The adsorption sites and atomic spacings are determined by direct observation.

24710 **Microscopic theory of the structure, thermodynamics, and apparent chi parameter of polymer blends.** Schweizer, K.S.; Curro, J.G. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* **60**: No. 9, 809-812(29 Feb 1988). Contract AC04-76DP00789.

A general off-lattice microscopic theory of the equilibrium properties of polymer mixtures is developed based on reference interaction site model integral equation methods. A derivation of a random-phase-approximation—like scattering function is presented along with a fully microscopic, general formula for the effective chi parameter measured in small-angle neutron-scattering experiments. Numerical results for chi of an athermal, Gaussian-chain—polymer binary blend are presented as a function of concentration, packing fraction, molecular weight, and structural asymmetry.

24711 **Surface topography and impedance of metal-electrolyte interfaces.** Bates, J.B.; Chu, Y.T.; Stribling, W.T. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6030). *Physical Review Letters;* **60**: No. 7, 627-630(15 Feb 1988). Contract AC05-84OR21400.

The small-signal impedance of chemical cells with "blocking" electrodes is dominated at low frequencies (f<~100 Hz) by the impedance of the metal-electrolyte interfaces which is accurately represented by Z/sub i/ = A(jω)/sup -n/. The frequency exponent n, n<1, is sensitive to the texture of the interface, and several recent theories have been proposed that relate n with the fractal dimension d-bar of the rough interface. We find no correlation between n and d-bar from experiments using aqueous electrolytes and metal and semiconductor electrodes.

24712 **Conformation of ethylene glycol and phase change in silica sodalite.** Richardson, J.W. Jr.; Pluth, J.J.; Smith, J. V.; Dytrych, W.J.; Bibby, D.M. (Univ. of Chicago, IL). *Journal of Physical Chemistry;* **92**: No. 1, 243-247(14 Jan 1988). Contract W-31-109-ENG-38.

The crystal structure of silica sodalite, including possible locations for encapsulated ethylene glycol, was determined at room temperature by using a combined single-crystal X-ray and powder neutron diffraction analysis. Unit cell composition: $Si_{12}O_{24}$ x $2C_2H_4(OH)_2$, M/sub r/ = 845, cubic, Im3m, a = 8.830 (1) A (X-ray), a = 8.8273 (1) A (neutron). These refinements reveal that the correct space group for silica sodalite is Im3m (rather than I43m) and, therefore, that the sodalite framework is fully expanded. At room temperature, each sodalite cage contains one ethylene glycol molecule which has a range of geometrical positions. Intramolecular distances for the ethylene glycol molecule are (X-ray) C-C 1.78 (4), C-O 1.30 (6) A, (neutron) C-C 1.70 (3), C-O 1.25 (3) A. The shortest distances (3.4 A) between oxygens of the framework and molecule are consistent with weak hydrogen bonding. From the neutron diffraction data it was found that a sluggish phase change from cubic to lower symmetry occurs upon cooling below 200 K. At 10 K, silica sodalite appears to be monoclinic with approximate cell parameters a = 12.250 (8) A, b = 12.471 (8) A, c = 8.512 (6) A, β = 91.37 (6)°, based on an indexing of 12 peaks, but the precise symmetry is as yet unknown.

24713 **Orientation of arachidate chains in Langmuir-Blodgett monolayers on Si(111).** Outka, D.A.; Stoehr, J.; Rabe, J.; Swalen, J.D.; Rotermund, H.H. (IBM Almaden Research Center, 650 Harry Road, San Jose, California 95120-6099). *Physical Review Letters;* **59**: No. 12, 1321-1324(21 Sep 1987).

The near-edge x-ray-absorption fine-structure technique is used to determine the orientation of cadmium- and calcium-arachidate chains on Si(111) at monolayer coverage. In our films the Cd-arachidate chain is found to be aligned along the surface normal and Ca arachidate is tilted by 33° +- 5° relative to Cd arachidate. The results are explained in terms of the surface bonding geometry of the terminal carboxylate group and the lateral interlocking of the zig-zag chains.

40 CHEMISTRY

REFER ALSO TO CITATION(S) 25264, 25265

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 24063, 24069, 24114, 24189, 24281, 24977, 25256

24714 (ARC/OSR—8706) Development of an analytical method to determine aromatics in heating oils and diesel fuels. Fuhr, B.J.; Holloway, L.R.; Reichert, C.; Steppler, J. (Alberta Research Council, Edmonton (Canada). Oil Sands Research Dept.). Jun 1987. 139p. (MICROLOG—87-05185). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A method employing supercritical fluid chromatography (SFC) with flame ionization detection (FID) was developed for the determination of the aromatics content in heating oils and diesel fuels. Separation between saturates and aromatics was accomplished on a packed silica column with supercritical carbon dioxide as the carrier fluid. The best separation was obtained at 35/sup 0/C and 3600 psi (24,800 kPa). The present method appears to be applicable to samples with final boiling points of up to 450/sup 0/C and is not restricted by sample color. The analysis time by SFC is approximately 15 min. Because of the similar response of the FID to both saturates and aromatics fractions, it is assumed that the integrated area percentages may be used directly to determine the aromatics content without the need for extensive calibrations. However, nonlinearity at higher concentrations does require that samples be diluted before analysis. It was not possible to calculate a sample recovery for analysis by SFC presumably because of poor injector repeatability, but this has no effect on the actual aromatics determination. There is a strong correlation between the results obtained by both SFC and flourescent indicator adsorption (FIA). Good correlations were also found between the results obtained by SFC and nuclear magnetic resonance, and by SFC and gas chromatography-mass spectrometry. It is suggested that the SFC could be used in place of FIA in refinery control laboratories.

24715 (CONF-871016—1) Thermodynamic modeling of chemical equilibria in metal extraction. Chaiko, D.J.; Fredickson, D.R.; Reichley-Yinger, L.; Vandegrift, G.F. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 22p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006006/JAW.

From 5. symposium on separation science and technology for energy applications; Knoxville, TN, USA (25 Oct 1987).

Models of equilibrium extraction data are being developed for use in computer simulations of metal extraction processes. The correlations are based on chemical mass action principles in which the effects of metal complexation and aqueous phase activity coefficients are considered. Activity coefficients in mixed electrolyte solutions at high ionic strengths are calculated using methods available in the literature. This modeling approach is demonstrated for HNO_3 extraction with both the PUREX and TRUEX solvents and for Am^{3+} extraction by octyl-phenyl-N,N-diisobutylcarbamoylmethylphosphine oxide, which is the primary extractant in the TRUEX solvent. 23 refs., 4 figs., 4 tabs.

24716 (CONF-871038—10) Droplet size characteristics and energy input requirements of emulsions formed using high-intensity-pulsed electric fields. Scott, T.C.; Sisson, W.G. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005912/JAW.

From 5. symposium on separation science and technology for energy application; Knoxville, TN, USA (26 Oct 1987).

Experimental methods have been developed to measure droplet size characteristics and energy inputs associated with the rupture of aqueous droplets by high-intensity-pulsed electric fields. The combination of in situ microscope optics and high-speed video cameras allows reliable observation of liquid droplets down to 0.5 μm in size. Videotapes of electric-field-created emulsions reveal that average droplet sizes of less than 5 μm are easily obtained in such systems. Analysis of the energy inputs into the fluids indicates that the electric field method requires less than 1% of the energy required from mechanical agitation to create comparable droplet sizes. 11 refs., 3 figs., 2 tabs.

24717 (CONF-8710275—2) Anomalous and resonance small angle scattering. Epperson, J.E.; Thiyagarajan, P. (Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005944/JAW.

From International conference on applications and techniques of small angle scattering; Argonne, IL, USA (26 Oct 1987).

Significant changes in the small angle scattered intensity can be induced by making measurements with radiation close to an absorption edge of an appropriate atomic species contained in the sample. These changes can be related quantitatively to the real and imaginary anomalous dispersion terms for the scattering factor (x-rays) or scattering length (neutrons). The physics inherent in these anomalous dispersion terms is first discussed before considering how they enter the relevant scattering theory. Two major areas of anomalous scattering research have emerged; macromolecules in solution and unmixing of metallic alloys. Research in each area is reviewed, illustrating both the feasibility and potential of these techniques. All the experimental results reported to date have been obtained with x-rays. However, it is pointed out that the formalism is the same or the analogue experiment with neutrons, and a number of suitable isotopes exist which exhibit resonance in an accessible range of energy. Potential applications of resonance small-angle neutron scatterings are discussed. 8 figs.

24718 (CSIR-SR-CHEM—272) Annual report 1987. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Chemical Research Lab.). 1987. 95p. (In English, Afrikaans). CSIR, Publications Distribution, P O Box 395, Pretoria, 0001, South Africa.

The 1987 Annual report of the National Chemical Research Laboratory of the CSIR, briefly discusses the research done through the past year at the Laboratory. This include parts on analytical chemistry, inorganic chemistry, molecular biochemistry, organic chemistry and structural chemistry. The inorganic chemistry division has developed extensive new chemistry of cyclopentadienylruthenium complexes and notable successes are achieved in the development of new synthetic routes to polypyrazolylborate complexes of ruthenium and osmium. The structural chemistry division briefly discusses the research interest in x-ray crystallography, NMR spectroscopy and theoretical chemistry.

24719 (CSIR-SR-CHEM—272, pp 29-35) Structural chemistry. 1987. CSIR, Publications Distribution, P O Box 395, Pretoria, 0001, South Africa.

In Annual report 1987.

Strong research interest in x-ray crystallography, NMR spectroscopy and theoretical chemistry, and the maintenance and expansion of the necessary instrumentation are essential to ensure that new developments and applications are mastered and are available to enhance the research and technological capabilities of the National Chemical Research Laboratory (NCRL). This part on structural chemistry briefly discusses the research done at the NCRL through the past year.

24720 (EUR—10874) ENDIX. A computer program to simulate energy dispersive X-ray and synchrotron powder diffraction diagrams. Hovestreydt, E...; Parthe, E.; Hovestreydt, E.; Benedict, U. (Geneva Univ. (CH). Lab. Cristallographie aux rayons X; Karlsruhe Univ. (DE). Inst. fuer Kristallographie; Commission of the European Communities, Karlsruhe (DE). European Inst. for Transuranium Elements). (Commission of the European Communities, Luxembourg). 1987. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752567/JAW.

A Fortran 77 computer program is described which allows the simulation of energy dispersive X-ray and synchrotron powder diffraction diagrams. The input consists of structural data (space group, unit cell dimensions, atomic positional and displacement parameters) and information on the experimental conditions (chosen Bragg angle, type of X-ray tube and applied voltage or operating power of synchrotron radiation source). The output consists of the

normalized intensities of the diffraction lines, listed by increasing energy (in keV), and of an optional intensity-energy plot. The intensities are calculated with due consideration of the wave-length dependence of both the anomalous dispersion and the absorption coefficients. For a better agreement between observed and calculated spectra provision is made to optionally superimpose, on the calculated diffraction line spectrum, all additional lines such as fluorescence and emission lines and escape peaks. The different effects which have been considered in the simulation are discussed in some detail. A sample calculation of the energy dispersive powder diffraction pattern of UPt/sub 3/ (Ni/sub /3Sn structure type) is given. Warning: the user of ENDIX should be aware that for a successful application it is necessary to adapt the program to correspond to the actual experimental conditions. Even then, due to the only approximately known values of certain functions, the agreement between observed and calculated intensities will not be as good as for angle dispersive diffraction methods.

24721 **(EUR—10997-EN) Certification of the contents (mass fractions) of Cd, Pb, Se, Cu, Zn, Fe and Mn in wholemeal flour and lyophilized brown bread reference materials. Wholemeal flour - CRM no. 189; brown bread - CRM no. 191.** Wagstaffe, P.J.; Griepink, B.; Muntau, H.; Schramel, P. (Commission of the European Communities, Luxembourg. Directorate General Telecommunications, Information Industries and Innovation; Commission of the European Communities, Ispra (Italy). Joint Research Centre; Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). 1987. 69p. Commission of the European Communities, Luxembourg. Office for Official Publications of the European Communities.

BCR information. Reference materials.

The report describes the preparation and certification of a wholemeal flour (CRM 189) and a lyophilised brown breas (CRM 191) for their contents (mass fractions) of elements of toxicological and nutritional importance: Cd, Pb, Se, Cu, Zn, Fe and Mn. Indicative values are also given for As, Ca, Cl, Cr, Hg, Mg, Na, Ni, P and K. Details are given of a preliminary intercomparison of methods for these elements in a wholemeal flour sample, homogeneity and stability studies on the two reference materials and the results and evaluation of the certification exercise which involved 21 European Laboratories. Summaries of the certification methods are also presented. The report concludes with a discussion of the most common sources of error in determining the elements of interest and the steps to be taken to control them. With 7 figs., 28 tabs.

24722 **(EUR—11001-EN) Certification of the content (mass fractions) of arsenic, cadmium, copper, cobalt, manganese, lead, selenium and zinc in a single-cell protein. CRM no. 274.** Griepink, B. (Commission of the European Communities, Luxembourg. Directorate General Telecommunications, Information Industries and Innovation). 1987. 74p. Commission of the European Communities, Luxembourg. Office for Official Publications of the European Communities.

BCR information. Reference materials.

This report describes the preparation of a single cell protein as a reference material. Homogeneity and stability of the material are studied. The applied methods for the determination of concentrations of As, Cd, Cu, Co, Mn, Pb, Se, and Zn are presented, the contents of which are resp.: 0.1, 0.03, 0.04, 13, 52, 0.04, 1 and 43 μg/g. With 5 graphs, 55 tabs.

24723 **(GKSS—86/E/61) Total reflection X-ray fluorescence analysis.** Michaelis, W.; Prange, A. (eds.). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1987. 102p. (In German). (CONF-8605327—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752230/JAW.

From 1. workshop on total reflection X-ray fluorescence analysis; Geesthacht, F.R. Germany (27 May 1986).

In the past few years, total reflection X-ray flourescence analysis (TXRF) has found an increasing number of assignments and applications. Experience of trace element analysis using TXRF and examples of applications are already widespread. Therefore, users of TXRF had the opportunity of an intensive exchange of their experience at the 1st workshop on total reflection X-ray fluorescence analysis which took place on May 27th and 28th 1986 at the GKSS Research Centre at Geesthacht. In a series of lectures and discussions dealing with the analytical principle itself, sample preparation techniques and applications as well as comuter programs for spectrum evaluation, the present state of development and the range of applications were outlined. 3 studies out of a total of 14 were included separately in the INIS and ENERGY databases. With 61 figs., 12 tabs..

24724 (GKSS—86/E/61, pp 7-18) **Development and state of total reflection X-ray fluorescence analysis.** Michaelis, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude, Germany, F.R. Inst. fuer Physik). 1987. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752230/JAW. (CONF-8605327—).

From 1. workshop on total reflection X-ray fluorescence analysis; Geesthacht, F.R. Germany (27 May 1986).

Since the first application of total reflection in X-ray fluorescence analysis at the beginning of the 1970's this method has been subject to continual modifications and improvements and has frequently competed with NAA, ICP and AAS as a micro-analysis process for traces in the nanogram and picogram range. A survey is given of the many applications published in the literature, particularly of applications in environmental research practised at the GKSS Research Centre.

24725 **(IC—87/142) Applicability of PIXE for multielemental analysis in a biomedical application.** Shakir, N.S. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701884/JAW.

The applicability of PIXE for multielemental analysis is demonstrated. The method is used in a major systematic study on hair samples using one target analysis. The pathological state considered is agitated elderly people. The main elements examined are S, K, Ca, Fe, Co, Ni, Cu, Zn, Se, Br, Hg and Pb. The minimum detectable limits are 1-10 ppm using 180 μg of dry hair at 25 μe irradiations for elements between K and Br. The significance of differences between the hair elements in control populations and patients suffering from the pathological conditions are investigated. Investigations of possible linear and multiple-correlations between elements in each population are made. The work indicates that some elements do exhibit variation with pathological state, and the multielement PIXE analysis gives useful information about the subject. (author). 13 refs, 4 figs, 6 tabs.

24726 **(INIS-mf—11129) 11th radiochemical conference. Programme, abstracts of papers, list of participants.** Prasil, Z. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1987. 181p. (In English and Russian). (CONF-8704276—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88701630/JAW.

From 11. radiochemical conference; Marianske Lazne, Czechoslovakia (21 Apr 1987).

The conference met in four sesions which discussed: Separation methods, Radioanalytical methods, Labelled compounds and Miscellaneous. The first session discussed extraction methods, ion exchange and chromatographic separation of radioisotopes. The second session heard papers on the application of these methods, e.g., in geochemistry, on the use of radioactive tracers in radiochemical analysis and the use of activation analysis in the determination of trace elements. The third session heard papers on the preparation of labelled organic compounds with isotopes /sup 3/H, /sup 14/C, radioiodine and /sup 32/P, on the preparation of RIA kits and on the chemistry and radiopharmacology of technetium compounds. The other contributions which could not be heard in any of the three sessions discussed, e.g., the preparation of elements on the cyclotron and microtron, the production of a new /sup 99m/Tc-generator, the participation of the IAEA in processing low- and medium-level radioactive wastes, etc. (E.S.).

24727 **(KEK—87-6) Spectrographic detection of nitrogen impurity in helium.** Mimori, Katsuhiro; Wake, Masayoshi. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jul 1987. 16p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752301/JAW.

A device to observe very small amount of nitrogen impurity in helium gas was developed for a liquefaction system of helium. The principle of detection is based on the optical spectroscopy of the discharge arc in the helium gas. The new detector uses 427.8 nm spectral line as the detection light source while the previous works in this type of detectors used 391.4 nm spectral line. The advantage of newly introduced spectral line is that there is no strong helium spectral line in the neighbor of the observed line. As a result, it became possible to build a simple and reliable impurity detector which can continuously observe very small amount of nitrogen in helium.

24728 **(KFKI—1987-65/G,J) Recent bibliography on analytical and sampling problems of a PWR primary coolant Suppl. 5.** Illy, H. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1987. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701947/JAW.

The present supplement reviews the subsequent literature following 5 bibliographies from 1980 to 1986 each, up till September 1987. It also includes some references overlooked in the first five volumes. The serial numbers are continued from the first five bibliographies. Cross-referencing was not intended. This bibliographical supplement of 161 references is arranged in alphabetical order; within each topic the references are listed alphabetically according to the name of the first author of each work. Works are in English unless otherwise marked.

24729 (LBL—22300, pp 197-200) **Improvement in high resolution image quality of radiation sensitive specimens achieved with reduced spot size of the electron beam.** Downing, K.H.; Glaeser, R.M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Although electron diffraction patterns extending to better than 3 A can be obtained from a number of thin ("two-dimensional") protein crystals, the resolution in images of these crystals has seldom reached beyond even 5 A. It is now evident that beam-induced specimen motion is major factor in limiting resolution. Long-range as well as short-range motion must occur in specimens as a result of the stress and local distortion around sites of defects produced in the specimen by radiation damage. This motion should be greatly reduced by restricting the area of the specimen that is illuminated at any one time. Not only should the total stress on the specimen be reduced in proportion to the area illuminated, but the area that is illuminated should be quite highly constrained by the unirradiated, surrounding area.

24730 **(ORF/ECE—841011) Molecular weight determination of CANMET pitch samples by gel permeation chromatography. Final report.** Das, B.S. (Ontario Research Foundation, Mississauga (Canada). Environmental and Chemical Engineering Div.). 11 Oct 1984. vp. (MICROLOG—85-3440). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Fifty-four pitch samples were analyzed for molecular weight distribution analysis by gel permeation chromatography. The GPC conditions used for the analysis of the pitch samples are tabulated, as are the results themselves. 2 tabs.

24731 **(RCM—01687) Characterization of colloids in groundwater.** Kim, J.I.; Buckau, G.; Klenze, R. (Technische Univ. Muenchen, Garching (Germany, F.R.). Lehrstuhl fuer Radiochemie). Jul 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752265/JAW.

Natural colloids in the Gorleben aquifer systems have been investigated as for their chemical composition, quantification and size distribution. Humic substances appear to be the major organic materials in these groundwaters, generating humic colloids which are analysed to be humic acid (and fulvic acid) loaded with a large number of trace heavy metal ions. These metal ions include natural homologues of actinides and some fission products in trivalent, tetravalent and hexavalent state. Concentrations of trivalent and tetravalent heavy metal ions are linearly correlated with the dissolved organic carbon (DDC) concentration in different groundwaters. The DOC is found to be present as humic colloids. The Am/sup 3+/ ions introduced in such a groundwater readily undergo the generation of its pseudocolloids through sorption or ion exchange reactions with humic colloids. The chemical behaviour of Am(III), being similar to the trivalent metal ions, e.g. Fe/sup 3+/, REE etc. found in natural colloids, has been investigated by laser induced photoacoustic spectroscopy (LPAS). Groundwaters from Ispra, Markham Clinton and Felslabor Grimsel. Bidistilled water and one of Gorleben groundwaters, Gohy 1011, are taken for the purpose of comparison. This groundwater contains the least amount of natural colloids of all Gorleben groundwaters hitherto investigated. An indirect quantification is made by comparison of the LPAS results with experiment from Latex solution. (orig./IRB).

24732 **(ANL-Trans—88-01) Device for magnetic separation of dry powdered or fine-grained material.** Rotter, W. (Steinkohlen-Elektrizitaet A.G. (STEAG), Essen (Germany, F.R.)). 23 Feb 1988. Contract W-31109-ENG-38. Translation of German Patent Application 1,017,552, October 17, 1957. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006989/JAW.

Claimed is a device for the magnetic separation of dry powdered or fine-grained material, which is transported past the poles of a magnet and separated magetically. The magnetic material is removed by conveyor belts. The device is characterized by the combination of a shaft located within a magnetic force field, through which the dry powdered or fine-grained material, loosened by the free fall, is carried past magnetic poles, with continuous nonmagnetic belts running in this shaft [and] equipped with bucket-shaped or pocket-shaped fins made of nonmagnetic material.

24733 **Improved chromatographic detection methods based on absorbance and ultrasonic measurements.** Skogerboe, K.J. Ames, IA; Iowa State Univ. (1987). 108p. University Microfilms Order No. 87-21,934.Contract W-7405-ENG-82.

Thesis (Ph. D.).

This dissertation describes three new chromatographic detection techniques which provide improved chromatographic selectivity, sensitivity, and detectability. The first chapter presents a basic introduction to chromatography and describes detection methods in gas and liquid chromatography. The project described in the second chapter is a laser-based absorbance probe utilizing fiber optic technology. The probe is applicable to microbore liquid chromatography, providing a sub-microliter cell volume with a 3-mm pathlength. Linear response is made possible by minimizing stray light. This is accomplished first by reducing reflections through refractive index matching, and second, by using a unique optical delay line and high-frequency modulation, which enables background correction through phase-sensitive detection. Chapter 3 describes a new thermal lens spectrometer suitable for microbore LC detection. A single laser is used and a single beam passes through the cell to simplify alignment. Baseline stability of 1×10^{-4} and lock-in detection are made possible by a reference bean and high-frequency modulation (150 kHz). Detectability (S/N = 3) is found to be 3 pg of benzopurpurin 4B at 90 mW excitation (514.5 nm). This corresponds to an absorbance LOD of 4×10^{-6} au in a 1-cm cell. In Chapter 4 a new detection method for gas chromatography is described. The response of the ultrasonic gas chromatographic detector is used to determine both the absolute weight and the molar concentration of an unknown analyte without a calibration curve. The method does not require that any physical properties of the analyte to be known. A detectability of 1 pg of hexane was found.

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REFER ALSO TO CITATION(S) 24061, 24091, 24182, 24188, 24230, 24282, 24337, 24622, 24718, 24849

24734 (BDX—613-3804) NMR analysis of a fluorocarbon copolymer. Smith, R.E.; Smith, C.H. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Oct 1987. Contract AC04-76DP00613. 13p. (CONF-880445—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88002364/JAW.

From 46. Society of Plastics Engineers annual technical conference; Atlanta, GA, USA (18 Apr 1988).

Vinylidene fluoride (VF_2) can be copolymerized with chlorotrifluoroethylene (CTFE) in an aqueous emulsion using a peroxide chain initiator. The physical properties of the resulting fluorocarbon polymer depend on the ratio of VF_2 to CTFE and the randomness of the copolymerization. When CTFE and VF are polymerized in an approximately 3:1 mole ratio, the resulting polymer is soluble in acetone (and other solvents) at room temperature. Using proton and fluorine-19 NMR, the mole ratio of CTFE to VF_2, the emulsifier (perfluorodecanoate) concentration, and the randomness of copolymerization can be determined. A trifluorotoluene internal standard is added to a d_6-acetone solution of the fluoropolymer. Proton NMR is used to determine the amount of VF_2. Fluorine-19 NMR is used to measure the amount of emulsifier and the randomness of copolymerization. Each analysis requires about 5 minutes, and is quite precise, with relative standard deviations from 3 to 10% (10 replicates analyzed). In addition, the results from NMR analyses agree well with wet chemical analyses. 4 refs., 3 figs., 3 tabs.

24735 (BNL—40769) Orientational effects in 3-n-hexadecylpyrrole Langmuir Blodgett films. Yang, X.Q.; Inagaki, T.; Skotheim, T.A.; Okamoto, Y.; Samuelsen, L.; Blackburn, G.; Tripathy, S. (Brookhaven National Lab., Upton, NY (USA); Polytechnic Inst. of Brooklyn, NY (USA); Lowell Univ., MA (USA); IGEN, Inc., Rockville, MD (USA)). 1987. Contract AC02-76CH00016. 15p. (CONF-8710283—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006369/JAW.

From Symposium on electroresponsive polymers; Upton, NY, USA (4 Oct 1987).

3-n-hexadecylpyrrole have been synthesized, and Langmuir Blodgett films of this compound have been studied by means of transmission and grazing incident reflection FT-IR spectroscopy. A comparison of the spectra at the two different polarizations shows that the hydrocarbon tails are oriented normal to the substrate surface for multilayer LB films. For the single monolayer LB films, the hydrocarbon tails are tilted with respect to the substrate surface possibly due to interactions between the pyrrole head groups and the platinum substrate. 11 refs., 6 figs., 1 tab.

24736 (CFFTP-G—85036) Lithium isotope separation. A review of possible techniques. Symons, E.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Feb 1985. 34p. (AECL—8708). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701790/JAW.

Published methods for /sup 6/Li-/sup 7/Li lithium isotope separation have been reviewed. Future demand for /sup 6/Li, whose main use will be as a tritium breeder in blankets surrounding the core of DT fusion power reactors, is likely to exceed 5 Mg/a in the next century. The applicability of the various available methods to such a large scale production rate has been assessed. Research on improving the effectiveness of current lithium isotope separation processes has been carried out worldwide in several major areas during the past decade; these include two-phase chemical exchange systems, ion exchange resin chromatography, highly isotope-selective techniques like laser photoactivation and radiofrequency spectroscopy. Chemical exchange systems appear to offer good potential in the near term for /sup 6/Li enrichment. 61 refs.

24737 (CONF-8703238—, pp 15-29) Theory of condensed matter and new materials. Fritsche, L. (Technischen Universitaet Clausthal and Sonderforschungsbereich, West Germany). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

An attempt is made to analyze the present state of first-principles methods used in solid state theory to elucidate where these methods derive their strength and why they may be expected to gain even more predictive power in the near future. The latter will depend on the success of recently contemplated improvements. As regards the ground state properties of solids, there are two - in principle - rigorous ways of treating the associated N-electron problem. One is based on the Hohenberg-Kohn-Sham (HKS) theory, which maps the electronic pair correlation onto a strictly local, energy-independent potential that occurs in the associated one-particle equations. The alternative approach, which will not be discussed in this paper, is connected with determining quasi-particle amplitudes from the Dyson equation, where the information on the electronic pair correlation is absorbed into a nonlocal energy-dependent self-energy operator. Distinctly different from HKS theory, which only applies to ground states, the quasi-particle scheme lends itself to describe excitations (e.g., interband transitions) just as well. They shall furthermore discuss a generalization of the HKS theory that explains why naive extensions of this approach to excited states have been relatively successful in a variety of cases.

24738 (CONF-8703238—, pp 31-44) Theory of quasiparticle energies: band gaps and excitation spectra in solids. Louie, S.G.; Hybertsen, M.S. (Lawrence Berkeley Lab., CA). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW. Contract AC03-76SF00098.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A first-principles theory for the band gaps and electronic excitation energies in crystals is described. Optical and photoemission spectra are properly interpreted as transitions between quasiparticle states of the many-electron system. The theory requires adequate treatment of the Coulomb interaction between the electrons, including exchange and dynamical correlation effects. The nonlocal energy-dependent electron self-energy operator is evaluated from first principles using the full dielectric matrix and the dressed Green's function. Quasiparticle energies for materials covering a wide range of metallicity and ionicity are presented. With no empirical input, the calculated band gaps, optical transition energies, and band dispersions are all within a few percent of experimental values. For semiconductors and insulators, they find that local field effects in the screening of the Coulomb interaction and dynamical renormalization are both crucial for accurate results. The present method also extends beyond the case of bulk crystals, e.g., to surfaces. Results on the surface state energies of the Ge(111): As and S(111):As surface are discussed and compared with experiment.

24739 (CONF-8703238—, pp 45-53) Quasiparticle calculation of the dispersion curves of gallium arsenide based on a full Hartree-Fock approximation. Padjen, R.; Paquet, D.; Bonnouvrier, F. (CNET Laboratoire de Bagneux, France). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors present for the first time a calculation of the one-electron excitations of gallium arsenide that explicitely accounts for the exchange nonlocality. The calculation has been performed in two steps: (1) an exact valence electron Hartree-Fock computation provides a self-consistent one-body density matrix and defines the one electron valence and conduction wave functions subspaces. (2) An effective Hamiltonian including screened exchange is constructed and diagonalized after projection onto the valence and the conduction subspaces separately. This leads to self-

consistent dispersion curves that compare favorably with experimental data.

24740 (CONF-8703238—, pp 55-64) **n-point Green's functions in the Anderson model.** Mancini, F.; Marinaro, M.; Nakano, Y. (Universita di Salerno, Italy). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

An exact solution is developed for the periodic Anderson model. In particular, a general analytical expression for the n-point Green function is derived. A perturbation expansion in the kinetic term of the Hamiltonian is used to develop a problem to be solved by considering a single f electron.

24741 (CONF-8703238—, pp 65-72) **Progress in the study of transition metal impurities in III-V and II-VI materials.** Fazzio, A. (Universidade de Sao Paulo, Brazil). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Transition metal impurities in tetrahedral semiconductors are discussed, with emphasis on electronic structure results. The trends with atomic number within the 3d series, and down-the-column trends for 4d and 5d metals in III-V compounds, are considered inclusion of many-electron effects is shown to be fundamental in the description of excitation and ionization process. Finally, a unified picture of these impurity centers is drawn, with recourse to the crystal vacuum level.

24742 (CONF-8703238—, pp 73-78) **Possibility of negative U systems for transition metals impurities in semiconductors.** Mota, R.; Fazzio, A. (Universidade Federal de Santa Maria, Brazil). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Using the Haldane-Anderson formalism they study the possibility of obtaining a negative U system for transition metal impurities in the semiconductors. They propose, even without including electron-lattice interaction, the occurrence of negative-U as a consequence of the impurity-host hybridization to explain why some oxidation states would be missing in these systems.

24743 (CONF-8703238—, pp 79-87) **Dielectric response to an acceptor ion in a Ga/sub 1-x/Al/sub x/As/GaAs/Ga/sub 1-x/Al/sub x/As quantum well.** Csavinszky, P.; Elabsy, A.M. (Univ. of Maine, Orono). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors consider the dielectric response to an acceptor ion placed at the center of a GaAs quantum well of finite depth and calculate the binding energy of heavy-hole and light-hole acceptor atoms as a function of the width of the well. They compare their values with those they have calculated from a hydrogenic approximation and find that consideration of the dielectric response of the GaAs quantum well leads to deviations with respect to the hydrogenic approximation. Specifically they find that their binding energies are larger in magnitude than those calculated from the hydrogenic approximation. They further find that the acceptor ion binding a heavy hole is much more affected by the dielectric response of the GaAs quantum well than the acceptor ion that binds a light hole.

24744 (CONF-8703238—, pp 89-97) **Ground state electronic properties of Fe-B complex pair in silicon.** Assali, L.V.C.; Leite, J.R. (Universidade de Sao Paulo, Brazil). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Ab initio self-consistent-field electronic state calculations have been carried out for an interstitial-iron-substitutional-boron impurity pair complex in silicon. The calculations do not provide support for the currently accepted microscopic ionic model for the pair. Rather, they have shown that the covalent effects play a basic role in determining the physical properties of the complex.

24745 (CONF-8703238—, pp 99-103) **Influence of hydrogen in the magnetism of Pd_3Fe.** Da Silva, E.Z.; Kuhnen, C.A. (Cidade Universitaria, Campinas, Brazil). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A particular model for the hydride Pd_3FeH is studied. The linear combination of muffin tin orbitals (LMTO) method is used to calculate the electronic structure of the hydride phase of Pd_3Fe and shows a drastic reduction of magnetic moments. By comparing the electronic structure of the hydride with the pure Pd_3Fe, it is understood why this reduction takes place.

24746 (CONF-8703238—, pp 105-113) **Band structure of silicon by the self-consistent variational cellular method.** Lino, A.T.; Takahashi, E.K.; Leite, J.R.; Ferraz, A.C. (Universidade Federal de Uberlandia, Brazil). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The self-consistent formulation of the variational cellular method has been developed in order to calculate the electronic structure of crystals with an arbitrary number of atoms per unit cell. Applications for silicon have been carried out. Silicon, chosen here as a test case, is treated as a face-centered cubic lattice with four atoms per unit cell by adding empty cells. The electronic charge density was taken muffin-tin, assuming a constant value in the interstitial region between the inscribed sphere and the Wigner-Seitz polyhedrum. The spherical symmetric electronic charge density in the inscribed sphere was obtained by adding a limited number of contributions of Brillouin zone states using the mean value point theory developed by Baldereschi and Chadi-Cohen. Their results are in good agreement with those obtained by other methods.

24747 (CONF-8703238—, pp 115-129) **Pathological aspects of restricted Hartree-Fock band calculations for metallic chains.** Delhalle, J.; Calais, J. (Laboratoire de Chimie Theorique Appliquee, Namur, Belgium). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

By analyzing the convergence properties of the lattice sums in the exchange part of the restricted Hartree-Fock orbital energy, they isolate the source of the nonanalytic behavior of a partially occupied band at the Fermi energy. This analysis shows how an extended system behaves qualitatively differently from a finite system but also provides a possibility of following the development of nonanalyticity as the size of the system grows.

24748 (CONF-8703238—, pp 131-136) **Brillouin zone treatment in total energy calculations of Peierls distorted chains.** Mintmire, J.W.; White, C.T. (Naval Research Lab., Washington, DC). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Most band structure calculations approximate the integral over the Brillouin zone of momentum (i.e., wave vector) dependent properties with an appropriately weighted sum over a discrete set of points in the Brillouin zone. The best choice for such a set of points has long been a point of discussion in crystalline band structure calculations. For one-dimensionally periodic systems, however,

the usual choice of points has been evenly spaced points in the one-dimensional Brillouin zone with equal weights. They have analyzed the exact error for the integral over the π band of a tight-binding model of trans-polyacetylene as a function of bond alternation. They find that the error in π band energy decreases in magnitude as q^{-2}, where q is the total number of points treated in the Brillouin zone, for the metallic polyacetylene system with equal bond lengths. As bond alternation increases, however, they find that the error in π band energy decreases in magnitude roughly exponentially as a function of bond alternation for any given value of q. They find that this systematic change in error as a function of bond alternation can lead to either apparent overestimation or underestimation of the equilibrium dimerization and stabilization energy of Peierls distorted systems using first-principles total energy calculations.

24749 (CONF-8703238—, pp 137-151) **Perturbational approach to aperiodicity of polymer systems.** Imamura, A.; Aoki, Y. (Hiroshima Univ., Japan). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

An iterative transfer perturbation method is applied to polyacetylene under some kinds of local perturbations at the level of the extended Hueckel method. This method rapidly provides the electronic states of nonperiodical polymers with good accuracy.

24750 (CONF-8703238—, pp 153-162) **Spectroscopic analysis of the conformations of polyaniline oligomers.** Duke, C.B.; Paton, A.; Salaneck, W.R. (Xerox Webster Research Center, NY). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The molecular conformations of four three-phenyl oligomers of polyaniline are determined via a CNDO/S3 molecular orbital analysis of optical absorption and valence-electron photoemission spectra for fully hydrogenated (Leucoemeraldine: N-4-aminophenyl-N′-phenyl-1,4 diaminobenzene and N-phenyl-N′-phenyl-1,4 diaminobenzene), partially hydrogenated (emeraldine: N-4-aminophenyl-N′-phenyl-1,4-diiminobenzene), and fully oxidized (pernigraniline: N-phenyl-N′-phenyl-1,4-diiminobenzene) species. The results provide a quantitative description of the optical absorption and photoemission data.

24751 (CONF-8703238—, pp 163-170) **Effect of additional fused rings on the stabilities and the band gaps of heteroconjugated polymers.** Lee, Y.S.; Kertesz, M. (Georgetown Univ., Washington, DC). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The aromatic (A) and quinoid (Q) forms of polythiophene (PT) have entirely different energy gaps: $\sim$ 0.5 eV for the quinoid form and $\sim$ 2 eV for the aromatic form, respectively. The energy gaps and stability of derivatives of PT are studied by total MNDO geometry optimization using energy band theory for the total energy calculations followed by a Hueckel energy band calculations to approximate the energy band structure. Addition of fused rings to PT reverses the order of stability of the aromatic and quinoid isomers and the ordering in the size of the energy gaps. Small energy gap polymers are suggested on the basis of the calculations.

24752 (CONF-8703238—, pp 171-180) **Density functional theory formalism.** Keller, J.; Ludena, E. (Universidad Nacional Autonoma de Mexico, Apartado). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A derivation and formulation of density functional theory, which eliminates the formal and practical inconsistencies and limitations of previous theories and allows its extension to stationary states other than the ground state, is given. The theory presented here can also be stated as a series of three theorems that define a family of its mathematical forms, as far as the physical content of the third theorem can either be implicitly incorporated in the density functional or explicitly in the procedure to find a solution to the equations. Examples of both cases are discussed, including the statement of configuration interaction procedure in density functional form.

24753 (CONF-8703238—, pp 181-190) **Density functional rationale of chemical reaction coordinate.** Tachibana, A. (Univ. of North Carolina, Chapel Hill). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A dynamical partitioning of the reaction field is proposed in order to study the electron density flow along the reaction coordinate. The density functional is constructed in a universal form, and a one-to-one correspondence is established between the density matrix and the electron density. The density functional is free from the constraints of N or v representability and is treated as a thermodynamic function that obeys the principle of maximum entropy. The functional derivative of the density functional with respect to the electron density is introduced as a response operator. The reaction paths are combinations of the dynamical processes of the electron density; the corresponding response operators and new type of thermodynamic functions and potentials are defined and shown to be useful. The characteristic features of the chemical reaction coordinate is discussed in terms of the new thermodynamic quantities. The importance of the softest vibrational mode as the chemical reactivity index is rationalized in terms of the density functional theory.

24754 (CONF-8703238—, pp 191-198) **Reflection properties of reaction paths in the reduced nuclear configuration space.** Mezey, P.G. (Univ. of Saskatchewan, Saskatoon). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Chemical reactions and conformational changes of N-atom systems can be described as displacement in a (3N-6)-dimensional metric configuration space M provided with a global metric. Although space M has a metric, it is not in general a vector space; it is a topological space. In contrast to the commonly used internal configuration spaces based on bond length/bond angle internal coordinates, and having no global metrics, within space M each internal configuration of the nuclei of the molecule corresponds to one and only one point of the space. This property of M is advantageous when analyzing chemical reactions. The global metric of M ensures that differences between any two internal configurations can be interpreted as a distance in this space that allows one to provide M with coordinate systems by turning M into a manifold with boundary. Certain formal reaction paths show some counter-intuitive behavior within this pace: they may undergo a formal reflection at some points of M. A condition, the tangent criterion, is used for the diagnosis of such reaction paths and for the determination of special nuclear configurations where such reflections occur.

24755 (CONF-8703238—, pp 199-215) **Generalized Langevin theory for many-body problems in chemical dynamics: explicit coordinate motion in molecular solvents.** Adelman, S.A. (Purdue Univ., West Lafayette, IN). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A practically useful and physically realistic generalized Langevin equation of motion that governs the dynamics of a small number of chemically relevant explicit solute generalized coordinates, e.g., a reaction coordinate or a normal mode coordinate, in a molecular solvent is developed. This equation of motion, which can be made the basis of analytical treatments of spectra and rate constants in molecular solvents, naturally represents the physics of the ultrafast relaxation regime in which cage effects governed by the

instantaneous cage restoring force exerted on the explicit coordinates play a dominant role. This equation of motion realistically describes both indirect (explicit coordinate → implicit coordinate → solvent) and direct (explicit coordinate → solvent) energy exchange processes as well as frequency modulation (dephasing) processes. This equation of motion also describes energy exchange with solvent vibrational as well as solvent translational-rotational degrees of freedom in a useful manner. The generalized Langevin equation for explicit coordinate motion in molecular solvents is based on the partial clamping model, which in turn assumes that (1) the liquid state motion of the explicit coordinates may be realistically approximated by small amplitude excursions from an initial point, and (2) the fluctuations in the local solvent density field are sufficiently small that the fluctuations of the perturbation density field induced by the small amplitude excursions may be ignored.

24756 (CONF-8703238—, pp 217-227) **Scattering of fast electrons and x-rays from CO_2 molecules.** Jain, A.K.; Tripathi, A.N.; Smith, V.H. Jr.; Thakkar, A.J. (Univ. of Roorkee, India). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Self-consistent field (SCF) wave functions for CO_2 are used to calculate cross sections for the elastic and inelastic scattering of fast electrons and x-rays from CO_2 molecules. The effects of basis set choice and free rotation on these cross sections are investigated. The utility of an approximate scheme to correct SCF inelastic cross sections for the effects of electron correlation is examined. The probability density for the interelectronic distance, or radial intracule density, is obtained as a by-product.

24757 (CONF-8703238—, pp 229-237) **Collisional time correlation function approach to the interaction of light with a polyatomic system.** Srivastava, D.; Micha, D.A. (Univ. of Florida, Gainesville). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The interaction of light with a polyatomic system is treated as a photon-scattering process in terms of time-correlation functions of transition operators. These are written as products of factors referring only to the molecule or the light field, so that the statistical properties of the polyatomic system and the light source can be easily incorporated. This procedure is developed for resonance absorption-emission and scattering of both thermal and coherent light.

24758 (CONF-8703238—, pp 245-249) **Kinetics of charge transfer at metal electrolyte interfaces: from classical to quantum statistics.** Blum, L.; Quijada, M.; Schmidt, P.P. (Univ. of Puerto Rico, Rio Piedras). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A survey of recent developments in the theory and experimental knowledge of charged interfaces is discussed in relation to the problem of electron transfer reactions. An attempt is made to reformulate the role of the solvent in bulk phase and at surfaces. Furthermore they discuss the effect of position-dependent tunneling on the reaction rate constant assuming simple distribution of the ions near the metallic interface.

24759 (CONF-8703238—, pp 251-266) **Theory of electron degradation and yields of initial molecular species produced by ionizing radiation.** Inokuti, M.; Dillon, M.A.; Kimura, M. (Argonne National Lab., IL). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW. Contract W-31-109-ENG-38.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Ionizing radiations generate in matter a large number of energetic electrons, which in turn collide with molecules in matter, produce ions and excited states, and thereby degrade in energy. The description of the consequences of many collision processes to the electrons and to matter is the goal of the electron degradation theory. They summarize the current understanding of this topic, which is important as a basis of radiation chemistry and biology. In addition, they present an initial report of their new work, namely, a generalization of the Spencer-Fano theory to time-dependent cases.

24760 (CONF-8703238—, pp 267-282) **Ab initio calculations on $H + C_2H_2 \rightarrow C_2H_3$ using unrestricted Moeller-Plesset perturbation theory with spin projection.** Sosa, C.; Schlegel, H.B. (Wayne State Univ., Detroit, MI). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Hydrogen addition to acetylene has been studied by molecular orbital methods with the unrestricted Hartree-Fock (HF) approach and with Moeller-Plesset (MP) perturbation theory up to fourth order using the 6-31G*, 6-31G**, and 6-311G** basis sets. For each basis set a number of points along an approximate reaction path were calculated by fixing the attacking H-C distance and optimizing all of the remaining parameters. At these geometries, single point MP4 calculations with and without spin projection were carried out, yielding the position, height, and shape of the addition barrier at the various levels of calculation with each of the three basis sets. The results of this approach were confirmed by a grid search of the region near the transition state using the 6-31G* basis set. The unprojected MP2, MP3, and MP4 barriers are too narrow and are 10-20 kcal/mol too high. With spin projection, the barriers are much lower and broader. At the PMP4SDTQ/6-311G** level, with zero point energy calculated at UHF/6-31G*, the vibrationally adiabatic barrier at 0 K is 4.0 kcal/mol, and the attacking H-C distance is 2.0 A.

24761 (CONF-8703238—, pp 313-319) **Electron transfer in a microscopically inhomogeneous medium.** Rips, I.; Jortner, J. (Tel Aviv Univ., Israel). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors explore the implications of static disorder on electron transfer (ET) in a microscopically inhomogeneous polar medium, where the environment of each solute is characterized by a single dielectric relaxation time, tau, with the distribution function of tau being related to the complex dielectric susceptibility. For the interesting situation of solvent-controlled ET, the decay of the population probability is nonexponential, which can be expressed in terms of a cumulant expansion. The microscopic decay function can be related to the macroscopic step-response function of the dielectric medium.

24762 (CONF-8703238—, pp 321-339) **Dynamical approach to electron transfer reactions.** Deumens, E.; Oehrn, Y.; Lathouwers, L. (Univ. of Florida, Gainesville). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A time-dependent approach to molecular dynamics involving both electrons and nuclei is formulated to study the interaction between electronic structure and nuclear geometry during electron transfer processes. The formulation uses the time-dependent variational principle to obtain a Hamiltonian system of first-order ordinary differential equations for wave function parameters from the quantum mechanical Schroedinger equation. They apply the formulation to a two-level model. In this first application, the nuclei are treated classically. The electron transfer process in both the normal and the abnormal case is studied and discussed. The role of the nuclear motion in the electron transfer process is clearly exhibited in both two and three moiety systems. For small coupling the difference in evolution between the dynamics using adiabatic and diabatic basis states shows the importance of nuclear motion in the process. Then various aspects of applications to realistic systems are discussed, and the techniques to treat those applications are outlined.

24763 (CONF-8703238—, pp 341-354) **Electron transfer reactions dynamically coupled to a dielectric medium: orientational effects and bridge assistance.** Mikkelsen, K.V.; Ratner, M.A. (Northwestern Univ., Evanston, IL). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A new treatment for studying electron transfer reactions is considered. The treatment allows for a detailed description of the electronic structure and is therefore appropriate for a complete description of weakly interacting electron transfer reactions. The initial state for the electron transfer system is selected by a variational scheme. The electron transfer is pictured to take place in an encounter complex consisting of the donor, the acceptor, and (optionally) a solvent/bridge molecule. The electronic structure of the encounter complex is dynamically coupled to the surrounding solvent, and the direct time evolution of the electron transfer system is followed by a nonlinear time-dependent Hartree-Fock method. They present examples with benzene-anion radical as the donor, pyridine as the acceptor, and water as the bridge/solvent molecule. The general formalism appears to be a useful approach for studying electron transfer reactions in solutions.

24764 (CONF-8703238—, pp 355-362) **Theoretical calculation of the capacity of an electrode/liquid electrolyte interface.** Mola, E.E.; Vicente, J.L. (INIFTA, La Plata, Argentina). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A self-consistent model capable of describing the interaction of a metal electrode/liquid electrolyte interface is presented. As in a real system, a capacity maximum shifted towards positive charges is obtained from the model. The metal is represented by the planar uniform background model (jellium). The solvent is described by a polar liquid whose response to charge is accounted for in terms of the local approximation. The interaction between the metal and ions is modeled by a charged plane placed near the metal surface. Charge neutrality of the whole system is preserved. The present model is a good approximation for highly concentrated solutions.

24765 (CONF-8703238—, pp 363-375) **Particles, and surfaces.** Ritchie, R.H.; Manson, J.R. (Oak Ridge National Lab., TN). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A brief review is given of some applications of a novel form of self-energy theory. These include the image force experienced by an electron near a metal, the van der Waals interaction between two molecules, and the polarization potential of atomic scattering theory.

24766 (CONF-8703238—, pp 389-405) **Rotational predissociation dynamics in weakly bound molecular systems: the Ar-N_2 and Ar-O_2 examples.** Gianturco, F.A.; Delgado-Barrio, G.; Roncero, O.; Villarreal, P. (Univ. of Rome, Italy). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The nuclear physics classification of certain reaction cross sections that appear to be abnormally large for specific (usually narrow) energy ranges describes them as being due to resonance states and usually explains them by assuming that at these energies intermediate, quasistable nuclear states exist and control the whole process. In the present work they discuss very similar events in van der Waals (VDW) molecules, whereby a stable monomer is prepared in a state that is rotationally excited, and the excitation energy is subsequently converted into intermolecular translational energy. The process therefore results in dissociation of the complex if the excitation energy exceeds the VDW binding energy, and they discuss several convenient procedures for computing both the energies at which such rotational predissociation (RP) processes occur and their relative probabilities. Computational examples for the O_2-Ar and N_2-Ar systems are reported.

24767 (CONF-8703238—, pp 407-15) **Centrifugal distortions in molecules: an ab initio approach with application to water.** Lohr, L.L. (Univ. of Michigan, Ann Arbor). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The author's procedure for employing analytical gradients of ab initio potential energy hypersurfaces in the description of centrifugally distorted molecules is applied to an asymmetric top, namely water. Both single determinantal (HF/6-31G**) and configuration-interaction (CISD/6-31G**) surfaces were utilized. Quartic centrifugal spectroscopic coefficients are obtained in both cases and are in reasonable agreement with experiment. It is shown that the calculated dependence of the energy upon the rotational angular momentum is better represented by a Pade approximant than by the conventional power series.

24768 (CONF-8703238—, pp 417-423) **Solution of the integral Dirac equation in momentum space.** Ishikawa, Y.; Rodriguez, W.; Alexander, S.A. (Univ. of Puerto Rico, Rio Piedras). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors discuss the solution of the integral Dirac-Fock equation in momentum space. Balanced momentum-space gaussian functions are used to expand the large and small components of the Dirac 4-spinors. They show that this approach, which has been successfully used in atomic Dirac-Fock calculations, works equally well in molecular Dirac-Fock calculations.

24769 (CONF-8703238—, pp 425-433) **Toward fully numerical evaluation of momentum space Hartree-Fock wave functions. Numerical experiments on the He atom.** Delhalle, J.; Defranceschi, M. (Facultes Universitaires Notre-Dame de la Paix, Namur, Belgium). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Direct evaluation of momentum space Hartree-Fock wave functions require accurate numerical integrations. The purpose of this computer experimentation with the Gauss-Legendre method is to examine the sensitivity of calculated properties on the truncation of the interval of integration for the radial variable.

24770 (CONF-8703238—, pp 435-456) **Husimi function for electron distributions.** Casida, M.E.; Harriman, J.E.; Anchell, J.L. (Univ. of Wisconsin, Madison). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors discuss the properties of a phase space distribution function that can be expressed as a Gaussian convolution of the Wigner function corresponding to the one-electron charge density matrix for a many-electron system. This distribution function is known as the Husimi function. It is real and nowhere negative and can be interpreted as a probability density for finding an electron in a particular coherent state or, equivalently, for finding it in a region of phase space consistent with the uncertainty principle. Information is not lost in the transformation from the Wigner function, which can be recovered. They discuss the relationships among various functions and their Fourier transforms. The Husimi function does not have the ordinary densities as marginals but rather Gaussian convolutions of them, from which the ordinary densities can be recovered. Advantages of the Husimi function over the Wigner function for the interpretation of electronic structure are discussed.

Illustrative results for the hydrogen atom and for the nitrogen atom at the SCF level are presented.

24771 (CONF-8703238—, pp 457-468) **Electron affinities of states of Sc and Cu.** Beck, D.R.; Cai, Z.; Aspromallis, G. (Michigan Technological Univ., Houghton). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

With this work, they begin their treatment of the transition metal electron affinities. A procedure, REDUCE, for reducing the number of parental couplings per configuration present in the first order wave function from as many as 100 to only a few is introduced. Progress toward a comprehensive relativistic-correlation theory is discussed. Several states in Sc^- were examined but none were found to be bound. Two new bound states were obtained for Cu^-: $3d^9\,4s\,4p^2\ ^5D$ and $3d^8\,4s\,4p^3\ ^7F^o$, with electron affinities 0.109 and 1.052 eV, respectively.

24772 (CONF-8703238—, pp 469-473) **Applying electron propagator theory to electron affinities.** Ortiz, J.V. (Univ. of New Mexico, Albuquerque). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Electron propagator theory is used to calculate vertical ionization energies of closed shell anions. Third order diagonal self-energies are calculated using the post-Hartree-Fock utility subroutines of Gaussian 82. Higher order corrections are estimated using the outer valence approximation. The number of operations needed rises no faster than the number required for the limited two-electron integral transformation. Basis set augmentations are made until changes in the computational results are small. Adiabatic ionization energies are obtained via many body perturbation theory calculations on the neutral potential energy surface. Applications to BeH- and MgH-give results in excellent agreement with photodetachment experiments.

24773 (CONF-8703238—, pp 475-485) **Calculation of spectra and spin-spin coupling constants using a coupled-cluster polarization propagator method.** Geertsen, J.; Oddershede, J.; Scuseria, G.E. (Odense Univ., Denmark). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors present a coupled-cluster polarization propagator method based on a coupled cluster singles and doubles reference state. Applications to the Be atom show that they may calculate electronic excitation energies with an average absolute error of about 0.08 eV using this method. They have also calculated the nuclear spin-spin coupling constant of $^1H^{19}F$ to be 524.4 cps, in good agreement with experiment. For Be there is a large effect of using coupled-cluster rather than a low-order Rayleigh-Schroedinger expansion, whereas the coupling constant of HF is less sensitive to this improvement in the reference state.

24774 (CONF-8703238—, pp 487-493) **Coupled-Cluster evaluation of geometrical derivatives of properties using non-relaxed orbitals.** Sekino, H.; Bartlett, R.J. (Univ. of Florida, Gainesville). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Analytical derivatives are dependent upon derivatives of the AO basis set and the MO relaxation. By separating these effects on derivatives, they can be individually studied. They show that the coupled-cluster single and double (CCSD) model introduces most of the MO relaxation effects required by gradients, hessians, dipole, and polarizability derivatives. This finding should make it possible to simplify analytical derivative evaluation at the CCSD level.

24775 (CONF-8703238—, pp 495-501) **Analytic evaluation of energy gradients for the single and double excitation coupled cluster (CCSD) wave function: a comparison with configuration interaction (CISD, CISDT, and CISDTQ) results for the harmonic vibrational frequencies, infrared intensities, dipole moment, and inversion barrier of ammonia.** Scuseria, G.E.; Scheiner, A.C.; Rice, J.E.; Lee, T.J.; Schaefer, H.F. III. (Univ. of California, Berkeley). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The analytic energy gradient method that they have recently implemented for CCSD wave functions is applied to fully optimize the pyramidal C/sub 3v/ and planar D/sub 3h/ structures of ammonia. Using a double-zeta plus polarization basis set, results for harmonic vibrational frequencies, infrared intensities, and dipole moments have been obtained. Comparison with different levels of truncated configuration interaction suggests that CCSD values are of better than CISD quality and generally closer to CISDTQ results.

24776 (CONF-8703238—, pp 503-512) **Geometry optimization of organometallic complexes: a study of basis sets.** Williamson, R.L.; Hall, M.B. (Texas A & M Univ., College Station). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Total geometry optimizations are reported for $Cr(CO)_6$, $HMn(CO)_5$, $Fe(CO)_5$, $Ni(CO)_4$, $Cr(C_6H_6)_2$, $Fe(C_5H_5)_2$, $Ni(C_4H_4)_2$, $Cr(NO)_4$, $(C_6H_6)Mn(CO)_3$ and $(C_6H_6)Cr(CO)_3$. A variety of basis sets were examined, and, based on the results, a relatively compact and accurate basis set is proposed. The differences between the calculated and experimental metal-carbonyl, metal-benzene, and metal-nitrosyl bond distances average 0.03, 0.08, and 0.07 A, respectively. Calculated metal-cyclopentadienyl bond lengths were found to be an average of 0.15 A longer than experimental bond lengths. Addition of electron correlation at the perfect pairing GVB level reduced the average difference in the metal-cyclopentadienyl bond length to 0.08 A.

24777 (CONF-8703238—, pp 513-521) **New symmetric group program for direct configuration interaction studies of molecules.** Guldberg, A.; Rettrup, S.; Bendazzoli, G.L.; Palmieri, P. (Univ. of Copenhagen, Denmark). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A symmetric group approach is presented for performing large scale, direct configuration interaction (CI) studies of electronic correlation effects in molecules. Two alternative graphical methods are described for representing very large sets of lexically ordered orbital configurations. One is suited for truncations in the number of core orbitals and the other for changes in the number of virtual orbitals. The Hamiltonian matrix elements are constructed using a graphical approach for localizing the one- and two-electron contributions. Compact and direct algorithms are given for calculating the irreducible representation matrices of S(N) for the line-up permutations. The program implementation of the CI procedure, PEDICI, calculates directly first-order molecular one-electron properties and transition probabilities from a multireference space for general excitation schemes.

24778 (CONF-8703238—, pp 523-532) **Use of an extended nucleus in Dirac-Fock Gaussian basis set calculations.** Ishikawa, Y.; Quiney, H.M. (Univ. of Puerto Rico, Rio Piedras). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Basis set balance in the expansion of the large and small components of Dirac 4-spinors has proved successful in preventing

the blatant variational failure that has plagued Dirac-Fock basis set expansion calculations. The criterion of basis set balance, however, was derived from the Dirac equation assuming that the external Coulomb potential V satisfies the condition absolute value of V << c^2. Consequently, for a finite value of c, a conventional balanced basis does not necessarily satisfy the boundary condition at the origin, although it may recover the correct nonrelativistic limit as c approaches infinity. This is the case with balanced Gaussian basis calculations that employ the point nucleus approximation. They show that this drawback may be removed by forfeiting the point nucleus approximation in favor of a finite nucleus of uniform proton charge distribution: the imposition of the finite nucleus boundary causes the solution to be Gaussian at the origin.

24779 (CONF-8703238—, pp 533-538) **Studies in the paired orbital method. I.** Pauncz, R.; Kirtman, B.; Palke, W.E. (Univ. of California, Santa Barbara). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

An extension of the alternant molecular orbital method to nonalternant molecules is presented. The key step involves generation of a set of localized virtual orbitals that are paired to the localized occupied orbitals (LMO's). Each of the paired virtuals is required to occupy the same region of space as the corresponding LMO by applying a generalization of the Edmiston-Ruedenberg localization criterion. Illustrative calculations are reported for the water molecule. Using a double-zeta basis, it is found that the new paired orbital (PO) method gives approximately 20% of the available correlation energy at R = R/sub e/, 1.5R/sub e/, and 2R/sub e/. They speculate that the PO wave function may provide a good initial approximation for a subsequent many-body perturbation treatment.

24780 (CONF-8703238—, pp 539-545) **Excited state properties utilizing effective core potentials.** Kilzer, P.A.; Kurtz, H.A. (Memphis State Univ., TN). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Effective core potentials are utilized in conjunction with polarization propagator calculations of excited state properties. The propagator method employed is based on an antisymmetrized geminal power wave function as the reference state. Calculations are presented on the low-lying excited states of HF and NaH. All-electron and valence-electron results are compared for HF. The choice of basis set is found to be very important for obtaining good results.

24781 (CONF-8703238—, pp 547-554) **Possible solution to the rotational invariance and silicon parameter problem in the MNDO approximation.** Deak, P.; Snyder, L.C. (State Univ. of New York, Albany). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

In the original formulation of the MNDO method, the approximation of two-center two-electron integrals over p orbitals is not rotationally invariant, and the coulomb-type integrals do not match their one-center counterparts. In recent computer codes the rotational invariance has been restored by dropping the original approximation for two-center exchange integrals over π orbitals, which at the same time disconnected these too from the one-center values. It is shown in this paper that the rotational invariance problem can be overcome in the framework of the original approximation. It is also demonstrated that the mismatch between the one- and two-center two-electron integrals may be the reason for the too short Si-Si bond lengths predicted by MNDO.

24782 (CONF-8703238—, pp 555-562) **Comments on the alteration of the Coulomb bound states by a barrier perturbation.** Natiello, M.A.; Braendas, E.J.; Engelmann, A.R. (Univ. of Uppsala, Sweden). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The Coulomb reconstruction phenomenon was originally studied in detail for a short range attractive potential by Zel'dovich. This idea was later initiated by Ericson and Krell in connection with absorptive interactions in the decay of charged particles in exotic atoms. The alteration of the Coulomb states by the action of a barrier V = ar²e/sup -r/ was considered recently by them. For a particular value of the parameter a, a resonant state is born, and for smaller values of a, a sequence of avoided crossings is observed between the would be resonance and the unperturbed Coulomb states, with an associated interchange of energy variation rate and <r> values. In this work they reexamine the variation of different observables with the parameter a for the lowest bound states of the system. The peculiar behavior of the observables as a is varied originates from a singularity in the problem for complex a.

24783 (CONF-8703238—, pp 563-567) **Study of the connected moments expansions for the correlation energy via an exactly soluble problem.** Cioslowski, J. (Georgetown Univ., Washington, DC). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The recently developed connected moment expansions (CMXs) for the ground state energy are tested on an exactly soluble N-body problem. For a weak correlation limit the second order CMXs reproduce the correlation energy exactly, whereas for a strong correlation limit they account for half of the correlation energy. Going to higher orders, the CMX-LT approximation appears to be the most effective one. The results indicate that the CMX technique should be promising for the calculation of the correlation energy of other systems.

24784 (CONF-8703238—, pp 569-572) **Effect of vibronic coupling on the long range intermolecular interaction.** Yamabe, T.; Asai, Y. (Kyoto Univ., Japan). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The nonadiabatic energy correction term of the hydrogen molecule at large separation is discussed to determine whether or not the nuclear motion induces the interatomic interaction potential. Nonadiabatic vibrational motion of nuclei induces the internal charge polarization of atoms to give the novel correction term to the London R^{-6} force. The correction term is (4/M) ($1/R^3$), which is important at large R despite the overwhelming magnitude of nuclear mass.

24785 (CONF-8703238—, pp 573-587) **Electron localization in clusters.** Landman, U.; Barnett, R.N.; Cleveland, C.L.; Scharf, D.; Jortner, J. (Georgia Institute of Technology, Atlanta). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The quantum path integral molecular dynamics method was utilized to explore the compositional, structural, and size dependence of localization mode of an excess electron in ionic and hydrogen-bonded clusters, providing information on the nature of surface states and on isomerization induced by electron attachment in large finite systems.

24786 (CONF-8703238—, pp 589-593) **Hybridization in some archimedean carbon clusters.** Kovacevic, K.; Graovac, A.; Babic, D. (Rudjer Boskovic Institute, Croatia, Yugoslavia). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Hybridization, bond, and deviation angles as well as strain energies in Archimedian carbon clusters C_{24}, C_{48}, C_{60}, and C_{120} are calculated within the iterated maximum overlap approximation.

24787 (CONF-8703238—, pp 595-602) **Properties of the BCl molecule studied by fourth-order many-body perturbation theory.** Mueller-Plathe, F.; Diercksen, G.H.F. (Max-Planck-Institut fuer Physik und Astrophysik, Garching bei Muenchen, West Germany). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Properties of the ground state ($X\ ^1\Sigma$) of the BCl molecule are calculated in complete fourth-order many-body perturbation theory. The equilibrium bond distance is determined to be R/sub e/ = 1.740 A (R/sub e/(exp.) = 1.716 A). Spectroscopic constants are evaluated from the potential curve and agree well with available experimental data. Static electric properties are computed by the finite-external-electric-field perturbation method. Apparently, no experimental information on these properties is available. Fully numerical Hartree-Fock results are used to estimate basis-set effects on the calculated quantities.

24788 (CONF-8703238—, pp 603-612) **Ab initio studies of hyponitrous acid.** Brown, R.E.; Mendenhall, G.D.; Bartlett, R.J. (Michigan Technological Univ., Houghton). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Three pathways are analyzed in a molecular orbital study of hyponitrous acid to determine likely methods of homolytic fragmentation and sources of alkoxy radicals. In particular geometry optimization and heat of formation are determined. The harmonic vibrational frequencies are included along with modes and symmetry elements.

24789 (CONF-8703238—, pp 613-621) **Study of the conformation of the dilithioacetylene molecule.** Jaworski, A.; Person, W.B.; Adamowicz, L.; Bartlett, R.J. (Univ. of Florida, Gainesville). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The conformation of the dilithioacetylene molecule has been investigated up to the CCSD + T(CCSD) level with the 6-311G*(*) basis. The geometry of the molecule has been fully optimized on the SCF and MBPT(2) levels with a variety of basis sets. It has been found that the equilibrium geometry is rather sensitive to the choice of the basis. Calculations on the CCSD + T(CCSD) level have shown that, although the second-order MBPT energy term destabilized the planar structure, the sum of the higher order corrections slightly stabilized this form. The planar doubly bridged (D/sub 2h/) structure is predicted to be the most stable one.

24790 (CONF-8703238—, pp 623-643) **Ab initio MRD-CI calculations for the propagation step of cationic polymerization of oxetanes based on localized orbitals.** Kaufman, J.J.; Hariharan, P.C.; Keegstra, P.B. (Johns Hopkins Univ., Baltimore, MD). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

In the propagation step of the cationic polymerization, oxetane reacts with the protonated oxetane formed in the initiation step, with concomitant ring opening of the protonated oxetane. To describe properly bond making or bond breaking, it is necessary to use MC-SCF or CI calculations. They have carried out ab initio MODPOT/VRDDO MRD-CI calculations (by the multireference double excitation-configuration interaction technique of Buenker and Peyerimhoff into which they have also meshed a number of desirable computational options for ab initio calculations on large molecules). The CI calculations were carried out on strictly orthogonalized localized occupied and virtual orbitals in the reaction region, with the remainder of the occupied molecular orbitals being folded into an effective CI Hamiltonian. The calculated potential energy surfaces indicate that a preferred pathway for this reaction resembles an S/sub N/2 reaction with the oxygen of the oxetane attacking linearly along the C_4-O direction of the protonated oxetane and inversion of the hydrogne around the C_4 atom.

24791 (CONF-8703238—, pp 645-660) **Comparison of ab initio MODPOT interaction energy components against large basis set MBPT (4) calculations for nitromethane dimer.** Sokalski, W.A.; Hariharan, P.C.; Kaufman, J.J. (Johns Hopkins Univ., Baltimore, MD). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Ab-Initio MODPOT SCE calculations using their own optimized well-balanced minimal basis sets have little basis set superposition error (BSSE) and have proven over the years to give reliable intermolecular geometries and interaction energies. Another approach, using ab initio potential functions from energy partitioned ab initio calculations, has also yielded reliable interaction energies and intermolecular geometries, including crystal structures. They used both of these techniques in comparing the results of a published large all-electron basis set calculation on the nitromethane dimer with the above methods. Their SCF intermolecular minimum energy was at the same internuclear distance as the large all-electron basis set. Their SCF interaction energy, corrected for BSSE, was only 0.4 kcal above the SCF energy of the large basis set SCF calculation corrected for BSSE. They also calculated the energy partitioned components with their ab initio MODPOT basis set and with the larger all-electron basis set. From values of the first-order electrostatic multipolar term from SCF and correlated monomer wave functions, the contribution to intermolecular interaction energy due to the use of correlated monomer wave functions has been estimated. For cyclic nitromethane dimer at equilibrium distance these effects approach 0.9 kcal/mol (nearly 1/4 of total interaction energy). In addition, they showed that the semitheoretical expression and parameters they use for estimating the dispersion energy gave results very close to the published variation-perturbation results from the larger basis set calculation.

24792 (CONF-8703238—, pp 661-668) **Ab initio MO study of Fe out-of-plane displacement and Fe-ligand vibration in five-coordinate Fe-porphyrin.** Saito, M.; Kashiwagi, H. (Institute for Molecular Science, Myodaiji, Japan). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Ab initio SCF MO calculations were carried out for fluoro(porphinato)iron(III) in order to elucidate the origin of the out-of-plane displacement of the iron atom and to analyze vibrational modes of the axial ligand bond. Potential curves as functions of the Fe-out-of-plane displacement and Fe-F bond distance were calculated for the ground state. By using these potential curves, the equilibrium iron displacement, Fe-F bond distance, and normal mode frequency of the Fe-F stretching vibration were evaluated. The values are in good agreement with experimental values within the differences 0.02 A, 0.06 A, and 50 cm^{-1}, respectively. It has been confirmed that the Fe out-of-plane displacement is caused mainly by the Coulomb repulsion between porphine nitrogens and fluorine anion.

24793 (CONF-8703238—, pp 669-676) **Basis sets and restricted Hartree-Fock instabilities in thiocarbonyls.** Fink, W.H. (Univ. of California, Davis). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

While calculating zero-field splitting terms for the lowest triplet state of 4H-pyran-4-thione, at the experimental geometry, it was found that the ground state was unstable with respect to an un-

restricted Hartree-Fock perturbation. The smallest fragment of the molecule retaining this instability was found to be diatomic CS. The instability is dependent on the basis set used for the calculation. The instability and its relationship to basis set, equilibrium geometry, and the importance of polarization functions for second row elements has been explored for CS and H_2CS as a function of internuclear distance. Minimal basis set calculations involving second row elements may be particularly prone to such instabilities.

24794 (CONF-8703238—, pp 677-692) **Hylleraas-CI integrals in molecular calculations. II. Three- and four-electron integrals and tests for two-electron many-center integrals.** Largo-Cabrerizo, A.; Urdaneta, C.; Lie, G.C.; Clementi, E. (IBM Corp., Kingston, NY). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

In a previous paper, formulas for two-electron integrals over Cartesian Gaussian functions occurring in the Hylleraas-CI method have been given. This paper reports on the extension of those formula to three- and four-electron integrals and presents test results obtained by using the two-electron integrals for H_2. With only 2 p-type polarization functions on each atom, the ground state energy calculated for H_2 is only about 20 cm^{-1} higher than the exact value.

24795 (CONF-8703238—, pp 693-698) **E Matrix for the Loewdin α function, expanded in a Taylor series: an analytic treatment of molecular charge density near the origin.** Jones, H.W.; Bussery, B.; Weatherford, C.A. (Florida A & M Univ., Tallahassee). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

A displaced STO can be expanded in spherical harmonics with the coefficient functions or Loewdin α functions characterized by a C matrix. These α functions themselves may be expanded in a Taylor series that is characterized by its own E matrix. This expansion is necessary for the representation of the α function by a power series and for its evaluation about the origin. As an application, they find the power series for the molecular charge density in the vicinity of the center of a model diatomic molecule. Their analytic approach is general and yields excellent results.

24796 (CONF-8703238—, pp 699-712) **Schroedinger's equation and continued fractions.** Masson, D.R. (Univ. of Toronto, Ontario). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Various connections between Jacobi matrices, continued fractions, orthogonal polynomials, three-term recurrence relationships, and the time-independent Schroedinger equation are reviewed and applied to obtain bound states and/or resonances for (1) the inverted oscillator Hamiltonian (1/2) $(p^2 - r^2)$; (2) the Coulomb plus oscillator Hamiltonian $p^2 - zr^{-1} + (r + \beta)^2/4a^2$; (3) a general Hamiltonian $p^2 + V(r)$ in the lattice approximation with explicit examples for $V(r) = -z/r$ or λr. It is pointed out that a scattering theory follows naturally from the properties of the subdominant boundary value solution to the associated recurrence relationship. As an example they calculate the lattice Coulomb s wave phase shift.

24797 (CONF-8703238—, pp 713-728) **Freeon unitary group procedure and the structure of matter.** Matsen, F.A. (Univ. of Texas, Austin). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

There is presented a novel, coherent procedure, based on the unitary group, for the computation of the spectra of atoms, molecules, solids, nuclei, and elementary particles. These spectra cover a truly remarkable energy range from a fraction to billions of electron volts. The procedure employs freeon orbitals that are free of energetically inert orbitals; e.g., ordinary spin orbitals for electrons, isospin orbitals for nuclei, and the product of ordinary spin orbitals and color orbitals for baryons. The Pauli principle requires the freeon spaces to be conjugate to the inert spaces. The spaces are spanned by Gel'fand states that have a simple, compact, pictorial representation in the form of Gel'fand structures (tableaux). The Hamiltonian for all systems is a second degree polynomial in the generators of the unitary group with parameters that determine the spectral scale and distribution and whose matrix elements are computed Lie algebraically. The unitary group supplies the unitary group quantum number and is the head group of chains of groups that supply additional quantum numbers.

24798 (CONF-8703238—, pp 729-735) **Closed formulas for one- and two-center harmonic oscillator integrals.** Palma, A.; Sandoval, L.; Morales, J. (Universidad Autonoma de Puebla, Mexico). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Closed formulas for one- and two-center matrix elements are derived for an analytical arbitrary operator function in the harmonic oscillator basis. The method is based on the Baker-Campbell-Hausdorff (BCH) theorem and Cauchy's integral formula. A table is displayed showing some examples for the two-center case. A pertinent relationship with other works is discussed.

24799 (CONF-8703238—, pp 749-750) **Approach to equilibrium and lyapunov converters.** Kumicak, J.; Braendas, E. (Univ. of Uppsala, Sweden). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Time evolution is reversible in both quantum and classical systems. It is shown that information loss will occur where very strong variants of convergence are applied to the spectral properties of the group generator. Lyapunov converters are shown to map reversible group evolution into irreversible evolution.

24800 (CONF-8703238—, pp 751) **Rayleigh-Schroedinger perturbation expansions for a hydrogen atom in a polynomial perturbation.** Vrscay, E.R. (Univ. of Waterloo, Ontario). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Rayleigh-Schroedinger (RS) perturbation expansions for the eigenvalues E/sub NLM/(λ) of a hydrogen atom in the general polynomial perturbation $V(r) = a\lambda r + b\lambda^2 r^2$, $a,b > 0$, are studied. When $a^2 = b$, the ground state energy is exactly $E(\lambda) = 1/2 + (3/2)a\lambda$, i.e., the RS series is truncated. In the case $a^2 > 2b$, the RS series is negative Stieltjes. In general, when $\lambda < 0$, a well of depth w similarly ordered to $-a^2/(4b)$ (note the λ independence) is situated at r/sub w/ = a/(2b absolute value of λ). When $a^2 > 2b/N^2$, a tunneling of the wave function psi/sub NLM/(λ) is possible between the double wells, creating a pair of asymptotically degenerate eigenstates separated by a gap ΔE(λ). The large order behavior of the RS coefficients E/sub NLM//sup (n)/ may be computed from a dispersion formula involving ΔE(λ). A Bender-Wu-type formula, E/sup (n)/ ~ (-1)/sup n+1/AC/sup n/Gamma(n + a), where A, C, and α are constants, is obtained. In the limit $b \to 0$, this formula reduces to the BW formula for the charmonium problem [1]. For excited states, stricter inequalities must be obeyed for Stieltjes behavior. The E/sub NLM//sup (n)/ may be calculated either numerically or in closed form via the so(4, 2) Lie algebraic technology for such hydrogenic problems.

24801 (CONF-8703238—, pp 753-754) **Quantum chemical calculations on ion pairs. II. Structure of haloacetic acids in aqueous solution.** Contreras, R.R.; Aizman, A.; Morales, D.; Llanos, M.E. (Univ. of Chile, Santiago). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The behavior of haloacetic acids in water is analyzed. The halogens of interest are chlorine and fluorine. It was determined that the solvation free energy is related to the strong acid behavior and the hydrated proton is associated with the halogen end of the anion.

24802 (CONF-8703238—, pp 755) **Exact projection method for the lowest eigenstate of singular multidimensional Schroedinger equations.** Bessis, D.; Handy, C.R. (Atlanta Univ., GA). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

For the general Schroedinger equation, with totally unbounded potential, one can single-out the ground state equation in an exact manner: the Schroedinger equation is replaced by an infinite set of hierarchical inequalities fulfilled by the moments of the ground state solution. Each of the inequalities provide upper and lower bounds to the ground state eigenvalue. These bounds improve rapidly with the number of inequalities considered. Furthermore, they show that these inequalities define convex sets in the appropriate space: the problem can therefore be reformulated in terms of linear programming. This makes their program highly practical.

24803 (CONF-8703238—, pp 757-758) **Renormalized inner projection, symbolic computation, and Loewdin rational approximants in explicit form.** Cizek, J.; Vinette, F.; Vrscay, E.R. (Univ. of Waterloo, Ontario). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Loewdin's inner projection [1] provides very good bounds for a number of Hamiltonians. Last year [2] a renormalized version of the same technique was shown to yield spectacular results even for a one-dimensional reference manifold. First, they study systematically the quartic, sextic, and octic anharmonic oscillators with multidimensional manifolds. Good results are obtained even for the difficult octic case. A scaling transformation followed by an optimization condition yields an exact relationship between a renormalized coupling constant, kappa, and the actual one, β. Symbolic computation [3] allows them to express the Loewdin rational approximants explicitly in terms of the trial input energy variable epsilon and kappa.

24804 (CONF-8703238—, pp 759-760) **Many-body studies of the structure and spectra of CO_3.** Canuto, S.; Diercksen, G.H.F. (Max-Planck-Institut fuer Physik und Astrophysik, Garching bei Munchen, West Germany). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The CO_3 molecule was first produced [1] in a gas phase reaction between O(1D) and CO_2. It has not been possible so far to characterize reliably its ground state geometry [2-5], but it appears to have a singlet ground state [3] with C/sub 2v/ symmetry [6-8] with a cyclic structure formed by a carbonyl bond and two symmetrically equivalent single bonds. In their studies a full geometry optimization in the fourth-order MBPT approximation limited to single and double substitutions has been performed using a double-zeta plus polarization basis set. The results [9] are found to be very dependent on correlation, and at the highest level considered they find a C=O bond very close to the carbonyl bond in cyclopropanone and a weak bond between the two symmetrically equivalent oxygen atoms. Besides being of astrophysical interest [10], CO_3 participates as an intermediate in several chemical reactions. They have also considered $CO_2 + O(1D) \rightarrow CO_3$ and $CO_3 + CO \rightarrow 2CO_2$, obtaining the energies involved in both processes at the level of full fourth-order MBPT approximation with inclusion of all single, double, triple, and quadruple substitutions [9]. In addition polarization propagator calculations at different levels of excitations with a double-zeta plus diffuse and polarization basis set have been performed on the title compound, CO_3, to characterize its low-lying excited states.

24805 (CONF-8703238—, pp 761-762) **Preliminary report on a local-density functional study of polysilane chains.** Mintmire, J.W. (Naval Research Lab., Washington, DC). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The electronic structure of polysilane systems have been studied using a linear combination of atomic orbitals local-density functional method. Within the chosen constraints, the minimization of total energy resulted in 2.45 A bond lengths for the Si-Si bonds. Calculated values for the direct band gaps are the uncertainties typically found in local-density calculations, and is consistent with experimental values.

24806 (CONF-8703238—, pp 763-764) **Experimental and theoretical studies of the stabilities and infrared spectra of the cytosine tautomers.** Kwiatkowski, J.S.; Person, W.B.; Szczepaniak, K.; Szczesniak, M. (N. Copernicus Univ., Torun, Poland). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Infrared spectra of cytosine molecules isolated in low-temperature matrices have been measured [1], and comparison of these spectra with those for several derivatives of cytosine has been made [2, 3]. An analysis of the spectra shows that the isolated cytosine molecules exist in an equilibrium between two tautomers - amino-oxo(o) and amino-hydroxy(h)- with preference for the latter (tautomeric constant K/sub t/(h/o) similarly ordered 2-3). The imino-oxo(i) tautomer of cytosine, which is postulated to be important in spontaneous point mutations, has not been detected. Considering the sensitivity of the experimental measurement, they presume that the concentration of this form, if present at all, is less than about 3%. Quantum-mechanical studies have been devoted to interpretation of the infrared spectra of the h and o tautomers of cytosine as well as to estimation of the tautomeric stabilities of different tautomers of the isolated cytosine molecule [1, 2, 4]. The vibrational spectra (frequencies, intensities) have been calculated at the SCF level using a 3-21G basis set at the 3-21G optimized geometries of the tautomers. The calculated frequencies and intensities for in-plane and out-of-plane modes agree well enough with the corresponding experimental values to provide a basis for preliminary assignments.

24807 (CONF-8703238—, pp 765-766) **Experimental and theoretical studies of tautomers of nucleic acid bases.** Person, W.B.; Szczepaniak, K.; Szczesniak, M.; Kwiatkowski, J.S.; Hernandez, L. (Univ. of Florida, Gainesville). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Recent experimental studies of the infrared spectra of the nucleic acid bases isolated in inert rare gas matrices have established the tautomeric forms that exist in equilibrium for these isolated bases. Here they shall review these results and compare recent ab initio calculations of relative stabilities with the experimental observations. The experimental studies show that isolated uracil and thymine exist only in the oxo form. Adenine is also found only in the amino form. The biologically important cytidine analogue, 1-methylcytosine, is also found to exist only in the amino-oxo tautomeric form. These results all agree with earlier studies of tautomerism of the bases in solution. However, isolated cytosine molecules exist in both amino-oxo and amino-hydroxy forms, with the latter form predominating. Isolated guanine exists in tautomeric equilibrium between amino-oxo and amino-hydroxy tautomeric forms, both for N(7)H and N(9)H tautomers of the imidazole ring. The isolated biologically important guanine analogues 9-methylguanine and 9-ethylguanine are found in tautomeric equilibrium between amino-oxo and amino-hydroxy tautomeric forms, with the latter form predomi-

nating. Quantum-mechanical estimations of the relative stabilities of the tautomers of the bases have been made by calculation of the several contributions to the relative energies at the SCF level (with 6-31G* basis set at 3-21G optimized geometries), electron correlation energies [MBPT(2)/6-31G*//3-21G], and zero-point vibrational frequencies.

24808 (CSIR-SR-CHEM—272, pp 10-16) **Inorganic chemistry.** 1987. CSIR, Publications Distribution, P O Box 395, Pretoria, 0001, South Africa.

In Annual report 1987.

The part on inorganic chemistry in the annual report of the National Chemical Research Laboratory, briefly discusses the research that has been done through the past year. Impetus was given to a ligand synthesis programme evolving around tertiary phosphorus ligands with unusual coordinating properties. Extensive new chemistry of cyclopentadienylruthenium complexes is developed and notable successes are achieved in the development of new synthetic routes to polypyrazolylborato complexes of ruthenium and osmium.

24809 **(FRCEA-TH—20) Catalytic properties and dynamic behaviour of uranium complexes.** Le Marechal, J.F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Paris-11 Univ., 91 - Orsay (France)). Jan 1986. 192p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88752166/JAW.

The catalytic properties of organometallic uranium III and IV compounds in solution as well as reaction mechanisms are studied. The structure in solution of CpUCl/sub 3/L/sub 2/ (L=THF, HMPA, OPPh/sub 3/, OP(OR)/sub 3/) is investigated. When L=HMPA, the complex exists in two isomers in equilibrium with the L ligands either in trans or mer-cis configuration. The isomerization (Ea=92 kJ mol/sup -1/) as well as the bimolecular exchange with an outer sphere ligand L are observable in /sup 1/H and /sup 31/P NMR, and quantified with the spin saturation transfer technique in several solvents and at different temperatures between 230 and 330 K. This property is extended to other ligands. The compound U(AlH/sub 4/)/sub 3/ is synthetized. This compound catalyses the hydroalumination of olefins by LiAlH/sub 4/ with a very good anti-Markovnikov regioselectivity. A simple mechanism for this reaction is suggested. The reactions of the organoaluminates products with several reactants (D/sub 2/O, I/sub 2/, CH/sub 2/O, Allyl-Br...) has been shown to be a powerful synthetic tool. Some specific alkenes and alkynes exhibit an interesting behaviour as dimerization or β-alkyl elimination which is easily interpreted by our mechanism.

24810 **(IC—86/352) Percolation transition in an irreversible-surface reaction model.** Sadiq, A. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701838/JAW.

Monte Carlo simulation studies of percolation transition in a surface reaction model, describing the oxidation of carbon monooxide on a catalytic surface, are presented. The percolation transition for adsorbed oxygen atoms occurs below the poisoning transition where carbon mono-oxide completely covers the surface of the catalyst, and takes place for an oxygen coverage of about 52%, which is close to the percolation transition in an Ising lattice gas with nearest-neighbour attractive interactions. In several respects the oxygen clusters near the percolation threshold resemble those of the Ising lattice gas near its critical point. (author). 13 refs, 5 figs.

24811 **(IC—87/121) Time evolution of an irreversible recombination process.** Sadiq, A.; Yaldram, K. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701864/JAW.

The time evolution of the irreversible catalytic recombination process, A + B -> inert is studied both analytically as well as by computer simulation. A rate equation describing this process is derived. For situations where one of the species poisons the catalyst, the minority species, under certain conditions, is found to decay exponentially. Computer simulation results also indicate exponential decay for intermediate times. Near the poisoning transition, x/sub A/ ≅ x/sub B/, the average relaxation time is found to diverge as tau ~ (1)/(0.5-x/sub A/)/sup γ/ with $\gamma \cong 1.3$. Here x/sub A/ and x/sub B/ are the compositions of A and B in the gas. (author). 6 refs, 4 figs.

24812 **(IC—87/149) Electrical double layer of metals in water irradiated by high intensity pulsed ultrasonic field.** Johri, G.K.; Iernetti, G. (International Centre for Theoretical Physics, Trieste (Italy); Trieste Univ. (Italy). Ist. di Fisica). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701891/JAW.

The effect of irradiation by high intensity pulsed ultrasonic field on the electrical double layer created when zinc, cadmium, lead, copper, silver, nickel, platinum, tin and iron are placed in distilled water is studied by measuring the difference in potential between metal electrodes and the intensity of the sonoluminescence. The threshold transducer voltages for the emission of light are also measured. The potential difference variation can reveal the different stages of the cavitation zone. A good correlation between the measured parameters, electrochemical potential, crystal structure and the melting point of the metals is found. (author). 9 refs, 1 fig., 2 tabs.

24813 **(LA-UR—88-659) Kinetic studies on the sulfidation of iron by sulfur bearing low-Btu gases.** Joyce, E.L. Jr.; Li, K.; Philbrook, W.O. (Los Alamos National Lab., NM (USA); Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Chemical Engineering). 1988. Contract W-7405-ENG-36. 11p. (CONF-880476—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006071/JAW.

From William O. Philbrook memorial symposium on the fundamentals of iron and steelmaking; Toronto, Canada (17 Apr 1988).

The use of a low-Btu gas as a reducing agent for iron oxide was shown to be favorable at temperatures of 800°C or greater. Little benefit was seen in terms of increased reduction rates at higher pressures (up to 5 atmospheres) or in varying either the H_2 concentration or CO/CO_2 ratio, within the range of a low-Btu gas. Sulfidation was found to occur in reaction with iron and not iron oxide. It was found that to avoid contamination of the reduced iron, very low levels of H_2S are necessary in the gas phase (≅0.05%). Kinetic data for the sulfidation of reduced iron oxide discs by a sulfur bearing low-Btu gas were taken to clarify the mechanism for the sulfidation reaction. Sulfidation was found to increase with H_2S concentration, system pressure and temperature, and to depend weakly on H_2 concentration and CO/CO_2 ratio. A model based on combined Multicomponent and Knudsen diffusion through the FeS product layer was developed and used to describe sulfidation. 40 refs., 16 figs.

24814 **(LBL—24692) Studies of surfaces using optical sum-frequency generation.** Hunt, J.H. (Lawrence Berkeley Lab., CA (USA)). Jan 1988. Contract AC03-76SF00098. 128p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88006334/JAW.

Sum-frequency generation (infrared-visible) was used as probe of molecular species at interfaces. The process being a second order non-linear optical process causes the technique to be surface-specific when used at an interface between two centrosymmetric media. The resonant enhancement of chi that occurs when the infrared input is tuned through a vibrational resonance allows one to determine the vibrational spectrum of the species adsorbed to the surface. The polarization dependence of the spectrum can be used to deduce the molecular orientations of the species at the interface. The laser system uses an amplified single pulse selected from the output train of a active/passive mode-locked Nd:YAG oscillator. The pulse contains sufficient energy to generate both an intense visible pulse via second-harmonic generation and an intense infrared pulse via optical parametric amplification. The first experiments were performed on series of alcohols at an air-glass interface. These experiments demonstrated that the basic technique produced spectra several orders of magnitude above the bare glass back-

ground. Although the spectra did not extend far enough into the infrared to identify the adsorbed species, the spectra were correlated with spectra taken in bulk samples. The technique was used to examine the spectra of a Langmuir film (air-water interface) of pentadecanoic acid at several surface densities. It was found that in the high density phase, the molecular hydrocarbon tails were fully extended and aligned nearly normal to the surface. At lower densities, the tail was free to bend and evidence of trans-gauche conformations was observed. The experiment makes use of the ability of sum-frequency generation to do in-situ spectral measurements not possible with other techniques. The use of difference-frequency generation was discussed.

24815 **(OH—85-124-K) Review of the inorganic and organometallic chemistry of zirconium.** Kalvins, A.K. (Ontario Hydro Research Lab., Toronto (Canada)). 12 Apr 1985. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI8870l962/JAW.

The results of a literature review of the inorganic and organometallic chemistry of zirconium are presented. Compounds with physical and chemical properties compatible with the requirements of an ir laser zirconium isotope separation process have been identified. 16 refs.

24816 **(SAND—87-0611C) The numerical simulation of viscous flows with change of phase and chemical reaction.** Gartling, D.K. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-880438—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003204/JAW.

From International conference on computational engineering science; Atlanta, GA, USA (10 Apr 1988).

A computational procedure, based on the finite element method, is developed to study the fluid dynamics of a chemically reacting system. Specifically, the problem involves the phase change (gelation) of an incompressible liquid due to an exothermic chemical reaction. Typical thermosetting materials are considered under conditions of both buoyancy-driven and forced flow. The focus of the present article is on the development of a robust numerical algorithm to handle the complexities of this class of flow problems. 1 ref., 5 figs.

24817 **(SAND—87-8248) SENKIN: A Fortran program for predicting homogeneous gas phase chemical kinetics with sensitivity analysis.** Lutz, A.E.; Kee, R.J.; Miller, J.A. (Sandia National Labs., Livermore, CA (USA)). Feb 1988. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006928/JAW.

SENKIN is a Fortran computer program that computes the time evolution of a homogeneous reacting gas mixture in a closed system. The model accounts for finite-rate elementary chemical reactions, and performs kinetic sensitivity analysis with respect to the reaction rates. The program considers five problem types: an adiabatic system with constant pressure; an adiabatic system with constant volume; an adiabatic system with the volume a specified function of time; a system where the pressure and temperature are constant; and a system where the pressure is constant and the temperature is a specified function of time. The program uses the DASAC software to solve both the nonlinear ordinary differential equations that describe the temperature and species mass fractions and the set of linear differential equations that describe the first-order sensitivity coefficients of temperature and species composition with respect to the individual reaction rates. The program runs in conjunction with the CHEMKIN package, which handles the chemical reaction mechanism.

24818 **Gas phase studies of Zn^+Z, Ag^+_3, and Ag^+_5.** Buckner, S.W.; Gord, J.R.; Freiser, B.S. (Herbert C. Brown Laboratory of Chemistry, Purdue University, West Lafayette, Indiana 47907). *Journal of Chemical Physics;* **88**: No. 6, 3678-3681(15 Mar 1988).

Laser desorption from ZnO and AgO produces small bare metal cluster ions. Laser desorption from a ZnO/AgO mixture produces an enhancement of the silver cluster ion signal with complete suppression of the zinc signal. The chemistry of Zn^+_2 indicates $IP(Zn_2)$ = 9.0 +- 0.2 eV and $D^0(Zn^+—Zn)$ = 0.56 +- 0.2 eV. The reactivity of Zn^+_2 with alkenes and alcohols is characterized by displacement of a zinc atom and formation of Zn^+—B (B = alcohol, alkene). The silver cluster ions are produced with excess kinetic energy; however, collisional cooling is achieved by trapping the cluster ions in a static pressure of argon. Charge transfer reactions indicate IP(Ag/sub n/)<7.0 eV (n = 3,5). Ag^+_3 and Ag^+_5 are unreactive with small alkanes, alkenes, and alcohols, but Ag/sub n/L^+_2 (n = 3,5; L = sec-butylamine) reacts with sec-butylamine via deamination and dehydrogenation indicating D^0 (Ag/sub n/L^+_2—butadiene) >1.73 eV.

24819 **Rate constants for the gas-phase reactions of OH radicals with 1,3-butadiene and allene at 1 atm in Ar and over the temperature range 305-1173 K.** Liu, A.; Mulac, W.A.; Jonah, C.D. (Argonne National Lab., IL). *Journal of Physical Chemistry;* **92**: No. 1, 132-134(14 Jan 1988). Contract W-31-109-ENG-38.

Absolute rate constants for the gas-phase reaction of the OH radical with 1,3-butadiene and allene in an argon atmosphere were measured at 1 atm over the temperature range 305-1173 K. It was not possible to determine the rate of the H abstraction reaction from either allene or 1,3-butadiene; an upper limit for these rates is about twice that which one would predict from the OH + ethylene reaction. At temperatures below 600 K, k(OH + 1,3-butadiene) = (1.4 +/- 0.1) x 10^{-11} exp[(440 +/- 40)/T] cm^3/(molecule.s) and k(OH + allene) = (6.7 +/- 0.9) x 10^{-12} exp[(100 +/- 50)/T] cm^3/(molecule.s). Above 600 K the rate constant of the allene reaction decreases weakly while the rate constant for the 1,3-butadiene reaction decreases markedly.

24820 **X-ray absorption near-edge structure evidence for direct metal-metal bonding and electron transfer in reduced Rh/TiO_2 catalysts.** Resasco, D.E.; Weber, R.S.; Sakellson, S.; McMillan, M.; Haller, G.L. (Yale Univ., New Haven, CT). *Journal of Physical Chemistry;* **92**: No. 1, 189-193(14 Jan 1988). Contract AC02-81ER10829.

A comparison of the X-ray absorption near-edge structure (XANES) of Rh metal and the intermetallic compounds RhTi and Rh_3Ti and the XANES of several Rh/TiO_2 catalysts suggests that the same kind of Rh-Ti bonding that occurs in the intermetallic compounds also develops in the catalysts after they have been reduced at temperatures higher than about 623 K. The results are interpreted as evidence for net electron transfer from reduced TiO_2 to at least some of the RH in the supported samples.

24821 **Entropy production and the Ostwald step rule.** Casey, W.H. (Sandia National Labs., Albuquerque, NM). *Journal of Physical Chemistry;* **92**: No. 1, 226-227(14 Jan 1988). Contract AC04-76DP00789.

Ostwald (Z. Phys. Chem. 1879, 22, 289) observed that crystallization from solution commonly proceeds via thermodynamically unstable phases. Linear irreversible thermodynamics has been used to examine this phenomenon. The authors show that, contrary to previous treatments, rates of entropy production are independent of the number of steps in a reaction sequence. Thus indirect reaction paths are not thermodynamically favored a priori relative to more direct formation of the stable product.

24822 **Solvatochromism: a dielectric continuum model applied to supercritical fluids.** Yonker, C.R.; Smith, R.D. (Pacific Northwest Lab., Richland, WA). *Journal of Physical Chemistry;* **92**: No. 1, 235-238(14 Jan 1988). Contract AC06-76RL01830.

The solvatochromic behavior of nonpolar supercritical fluids, in terms of the π^* Kamlet and Taft polarity/polarizability parameter, is compared to the McRae-Bayliss model. A break in the plot of π^* against the Onsager reaction field (F_0) is seen for the fluids studied at low reaction field values (low densities). The relationship between π^* and the Onsager reaction field (F_0) shows two regions of nearly linear behavior. The transition from the low-density region to higher density region, where a smaller dependence of π^* upon (F_0) is observed, is tentatively attributed to extensive solvent clustering about the solute. This hypothesis is supported by the behavior previously observed for the partial molar volume of the solute in the fluid anti v_2 infinity as a function of pressure. The

rapid change in anti ν_2 infinity is also shown to occur in the same region where the solvatochromic behavior of the fluid changes and the solute's solubility increases dramatically.

24823 Small-angle neutron-scattering studies of cobalt(II) organophosphorus polymers in deuteriobenzene. Thiyagarajan, P.; Diamond, H.; Danesi, P.R.; Horwitz, E.P. (Argonne National Lab., IL). *Inorganic Chemistry;* **26**: No. 25, 4209-4212(16 Dec 1987). Contract W-31-109-ENG-38.

Bis(2,4,4-trimethylpentyl)phosphinic acid, an extractant used to separate cobalt from nickel by solvent extraction, can form polymers when bound to large amounts of cobalt(II). The size and shape of these polymers have been measured by small-angle neutron scattering. The polymers form long thin chains, approximately 550 A long and about 9 A in radius. In some preparations, although the lengths were similar, the measured average cross-sectional radii were slightly larger, implying some cross-linking. The Co(II) polymers formed from the homologous series phosphoric acid bis(2-ethylhexyl) ester, (2-ethylhexyl)phosphonic acid 2-ethylhexyl ester, and bis(2-ethylhexyl)phosphinic acid were also measured. The first member of this series produced long thin rodlike polymers of constant cross-sectional radius (10 A) and variable lengths; the phosphonic and phosphinic extractants produced smaller polymers whose neutron scattering did not conform to a cylindrical model. 21 references, 5 figures, 6 tables.

24824 Development and application of a redox indicator method for the kinetics of oxidation of vanadium(II) ions by hydrogen peroxide and alkyl hydroperoxides. Kim, H.P.; Espenson, J.H.; Bakac, A. (Iowa State Univ., Ames). *Inorganic Chemistry;* **26**: No. 24, 4090-4093(2 Dec 1987). Contract W-7405-ENG-82.

The addition of the methyl viologen radical cation (PQ/sup .+/) to solutions of $V(H_2O)_6^{2+}$ and hydrogen peroxide or alkyl hydroperoxide provides a method for measuring the initial reaction rate. The kinetic data so obtained are consistent with the rate equation -d[peroxide]/dt = $k_1[V^{2+}][peroxide]$. Kinetic data are given for H_2O_2 [k_1 = 15.4 M^{-1} s^{-1} at 25.0°C) and for $RC(CH_3)_2OOH$, with R = CH_3 (3.0 M^{-1} s^{-1}), C_2H_5 (5.2 M^{-1} s^{-1}), and $CH_2C_6H_5$ (4.8 M^{-1} s^{-1}). 27 references, 2 figures, 2 tables.

24825 Kinetics and mechanism of the reactions of alkylchromium complexes with aqueous sulfur dioxide. Simmons, C.A.; Espenson, J.H.; Bakac, A. (Iowa State Univ., Ames). *Inorganic Chemistry;* **26**: No. 24, 4093-4096(2 Dec 1987). Contract W-7405-ENG-82.

The organopentaaquochromium(III) complexes, $(H_2O)_5CrR^{2+}$ (R = alkyl, substituted alkyl, benzyl, and substituted benzyl), react with SO_2 in aqueous perchloric acid solutions to yield $(H_2O)_5Cr^{3+}$ (~ 80%), $(H_2O)_5Cr(SO_2)R^{2+}$ (~ 20%), and alkanesulfinic acids. The reactivity pattern within the series (CH_3 > 1° ~ benzyl >> 2°) closely matches that observed earlier in electrophilic substitution reactions of these and other organometallic complexes. The competition between the solvent water and the oxygen or sulfur of the leaving RSO_3^- group is responsible for the formation of the two chromium products. 24 references, 3 figures, 1 table.

24826 Reduction of titanium(IV) and oxidation of titanium(III) by 1-hydroxy-1-methylethyl radicals. Bakac, A.; Espenson, J.H.; Lovric, J.; Orhanovic, M. (Rudjer Boskovic Institute, Zagreb, Yugoslavia). *Inorganic Chemistry;* **26**: No. 24, 4096-4099(2 Dec 1987). Contract W-7405-ENG-82.

Kinetic competition between TiO^{2+} and $Co(NH_3)_6^{3+}$ was used to study the reduction of titanium(IV) by the indicated aliphatic radical. The second-order rate constant is (1.1 +/- 0.1) x 10^6 M^{-1} s^{-1} at 25°C and 1.0 M ionic strength in aqueous 1 M 2-propanol. The rate constant is independent of [H^+] over the range 0.03-0.08 M. The method of stored free radicals, based on the homolysis of $CrC(CH_3)_2OH^{2+}$, was used to study the oxidation of titanium(III) by the same radical. The apparent second-order rate constant increased markedly with decreasing [H^+]. The inverse [H^+] dependence, unprecedented for oxidations by this radical, suggest that a transient intermediate is stabilized by the incipient formation of titanium(IV) already partly deprotonated, thus assisting in the formation of the species TiO^{2+}. Schemes by which this can be accomplished are suggested. 27 references, 2 figures, 2 tables.

24827 Dynamic behavior of reacting gas jets submerged in liquids. Cho, D.H.; Armstrong, D.R.; Bova, L. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-870816—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Technical Paper 87-HT-67.

A photographic study of a hydrogen chloride gas jet reacting in an aqueous solution of ammonia was conducted. The high-speed motion pictures taken revealed that the behavior of the reacting gas jet was highly dynamic and complex. The gaseous jet penetration ("plume") was not stationary, but underwent a change in shape and size with time, which appeared to be periodic or cyclic. Such dynamic plume behavior is attributed to the vaporization of ammonia due to reaction heat release. In fact, the overall plume behavior resembled that of a subsonic vapor jet condensing in liquid. The plume length measurements for large concentrations of ammonia seem to confirm the prediction that when the extent of vaporization is large, the plume length is mainly determined by the distance required for condensation of the ammonia vapor.

24828 (UCRL-Trans—12200) Preparation of N-(fluoroalkyl)anilines. Yamanaka, Hiroki; Kuwabara, Masaki; Komori, Masahiro; Otani, Masua; Kase, Koichiro; Fukunishi, Koji; Nomura, Mototeru. Translated from *Nippon Kagaku Kaishi ;* No. 1, 112-117(1983). Contract W-7405-ENG-48. 18p. NTIS, PC A03/MFA 01; 1; GPO Dep. Order Number DE88002755/JAW.

In order to prepare N-(fluoroalkyl)anilines the reactions of the various fluoroalkyl arene- and methanesulfonates with aniline were investigated. Sulfolane gave the best results among the solvents examined. N-(α,α,ω-Trihydroperfluoroalkyl)anilines, for example, could be prepared in sulfolane but not in other solvents. Fluoroalkyl o-nitrobenzenesulfonates proved to be a highly effective agent for N-fluoroalkylation of aniline in sulfolane. The reactions of N-ethylaniline with fluoroalkyl arenesulfonates in the same solvent led to ordinary N-fluoroalkylation, which was accompanied by the elimination of N-ethyl group and/or migration of the ethyl group to the para position to give the corresponding products. The reactions of fluoroalkyl o-nitrobenzenesulfonates with N-(hydroxyethyl)aniline in sulfolane afforded N-hydroxyethyl-N-(fluoroalkyl) anilines in good yields. 11 refs., 4 tabs.

24829 (UCRL-Trans—12201) Preparations and NMR (^1H and ^{19}F) studies of aryl 2,2,2-trifluoroethyl ethers and sulfides, and N-(2,2,2-trifluoroethyl) anilines. Nakai, Takeshi; Tanaka, Kiyoshi; Ishikawa, Nobuo. Translated from *Nippon Kagaku Kaishi ;* No. 12, 1888-1892(1976). Contract W-7405-ENG-48. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002756/JAW.

A variety of 2,2,2-trifluoroethyl compounds of the type CF_3CH_2X-C_6H_4-Y; X = NH, O, and S; Y = H, m-F, p-F, p-MeO, and p-Me, have been prepared and their ^1H and ^{19}F NMR spectra were measured. The ethers and sulfides were synthesized by the reactions of 1,1,1-trifluoro-2-iodoethane with sodium phenolates and benzenethiolates, respectively, while N-(2,2,2-trifluoroethyl)anilines were obtained by trifluoroacetylation of anilines followed by hydride reduction. The ^{19}F NMR data show the effect of hetero atoms (X) on the δ (CF_3) values, which decrease in the order: X = O, N, and S. The δ (CF_3) values are not affected by ring substituents (Y). On the other hand, the ^1H NMR data reveal the increase in the tau (CH_2) values in the order of X = O, N, and S. A small effect of Y on tau (CH_2) values were also observed; electron-donating groups such as Y = p-MeO and p-Me tend to increase tau (CH_2) values while electron-withdrawing groups (i.e., Y = m-F) decrease them. On the basis of the ^{19}F NMR data for m- and p-fluoro derivatives, the σ_1 and σ/sub R/° values for the XCH_2CF_3 substituents have been determined. The electronic effect of substituents XCH_2CF_3 is intermediate between those of $XCOCF_3$ and XCH_2CH_3. 11 refs., 1 fig., 3 tabs.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 24181, 24658, 24716

24830 (CONF-8608152—Vol.1-Summs.) 37th meeting of the International Society of Electrochemistry: Extended abstracts, Volume 1. (AN Litovskoj SSR, Vilnius). 1986. 416p. NTIS (US Sales Only), PC A18. Order Number DE88900404/JAW.

From 37. meeting of the International Society of Electrochemistry; Vilnius, USSR (1 Aug 1986).

Twenty-six papers are presented with three themes: deposition and dissolution of metals, membrane electrochemistry, and ionic melts and solid electrolytes. The papers will be processed separately for the data base. (DLC)

24831 (CONF-8608152—Vol.4-Summs.) 37th meeting of the International Society of Electrochemistry: Extended abstracts, Volume 4. (AN Litovskoj SSR, Vilnius). 1986. 507p. NTIS (US Sales Only), PC A22. Order Number DE88900405/JAW.

From 37. meeting of the International Society of Electrochemistry; Vilnius, USSR (1 Aug 1986).

A large number of extended abstracts are presented on organic electrochemistry, electrochemical energy conversion, electrochemical technology, and bioelectrochemistry. The papers will be processed separately for the data base. (DLC)

24832 (LBL—24601) Prediction of thermodynamic properties, including solubility equilibria and vapor pressures, for mixed aqueous electrolytes to high temperatures. Pabalan, R.T.; Pitzer, K.S. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Chemistry). Jan 1988. Contract AC03-76SF00098. 16p. (CONF-870594—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006317/JAW.

From International conference on thermodynamics of aqueous systems with industrial applications; Warrenton, VA, USA (10 May 1987).

A number of different models have been proposed in the literature that treat the thermodynamic properties of electrolyte solutions. The most frequently used at present is the ion-interaction or virial coefficient approach, which was initially developed by Pitzer (1973) and Pitzer and Kim (1974) for aqueous solutions near room temperature. Since the model is based on a general equation for the excess Gibbs energy of the aqueous fluid, any thermodynamic property can be obtained from the appropriate derivatives. Thus the model has been used to describe osmotic and activity coefficients, as well as volumetric and thermal properties (e.g., heat capacity and enthalpy) of aqueous electrolytes. Success of this model when applied to complex and concentrated electrolyte mixtures was initially demonstrated for calculations of equilibria at room temperature between a brine phase and one or more solids by Harvie and Weare (1980). In this study we show that the same success holds over a wider range of temperature conditions. The model is applied to calculations of solubility equilibria, as well as to calculations of vapor pressures of electrolyte mixtures to high temperatures. 32 refs., 8 figs., 2 tabs.

4005 Photochemistry

24833 (CONF-8703238—, pp 239-244) Generating wave functions from classical trajectory calculations: the divergence of streamlines. Stodden, C.D.; Micha, D.A. (Univ. of Florida, Gainesville). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Wave functions can be written, for short de Broglie wavelengths, in an eikonal form where the preexponential factor relates to the divergence of streamlines. A method is presented to calculate this divergence by generating the Jacobian of a variable transformation along a classical trajectory without requiring the simultaneous integration of adjacent trajectories. For a system with N + 1 degrees of freedom, there are $2(N + 1)^2$ differential equations that must be solved simultaneously to generate the trajectories and the Jacobian. Results are presented for a photodissociation cross section calculation in which the eikonal wave functions have been used in the transition integrals.

24834 (CONF-8703238—, pp 283-295) Theoretical analysis of photoaddition reactions of hydroxylazoaromatic compounds and the related thione analogs with olefins. Feng, J.; Zheng, X.; Zerner, M.C. (Univ. of Florida, Gainesville). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors examine the photoaddition of hydroxylazoaromatic compounds and related thione analogs with olefins. By examining the properties of the lowest lying singlet and triplet states, they conclude that the product distribution is best described by the unpaired spin density of the triplet state. This suggests that absorption of light by the aromatic is followed by conversion into the triplet, and this triplet is the active precursor. Since unrestricted molecular orbital calculations are easily performed on the lowest triplet of these aromatics, prediction of possible products is straightforward.

24835 (CONF-8703238—, pp 377-387) Complex perturbation and deperturbation procedures applied to photofragmentation cross-section calculations. Lefebvre, R.; Garcia-Sucre, M. (Universite de Paris-Sud, Orsay, France). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors describe a procedure to calculate resonance energies that is based on the addition of a complex perturbation to a one-channel or multichannel description of a quantum system. The perturbation has the effect of modifying the boundary conditions so that the perturbed problem leads to the search of the eigenvalues of a bound system. The energies cannot be exploited directly. A point Pade procedure is subsequently applied to remove the perturbation. Tests are made on a well-known one-channel example. Another application is made to two simple photofragmentation processes: photoionization of the ground state hydrogen atom and photodissociation of the HBr molecule. The complex perturbation in this instance is the change of the photon frequency into a complex quantity.

24836 (CONF-8703238—, pp 737-742) Photoelectron spectra of some compounds containing the trifluoromethyl group. Cvitas, T.; Novak, I.; Klasinc, L. (Rugjer Boskovic Institute, Zagreb, Yugoslavia). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The HeI and HeII photoelectron spectra of CF_3Cl, CF_3Br, CF_3I, CF_3CCH, CF_3CCl_3, CF_3COOH, CF_3COOCH_3, CF_3COOCF_3, $CF_3COCH_2COCH_3$, $(CF_3)_2CHOH$, CF_3CH_2OH, trifluoromethyltoluene, and 2,4,6-tris(trifluoromethyl)-1,3,5-triazine have been recorded under low and high resolution. Special attention has been paid to ionizations arising from MO's with a significant contribution of fluorine atomic orbitals. HeII/HeI intensity comparisons were also useful in the assignment of CF_3-group orbitals. The results indicate that the electronic structure of the CF_3 group remains rather unaffected by the rest of the molecule.

24837 (CONF-8703238—, pp 743-748) Transition to global stochasticity in a driven Morse oscillator. Yuan, J.M.; Gu, Y. (Drexel Univ., Philadelphia, PA). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

The authors studied the IR multiphoton excitation and dissociation process of a Morse oscillator drivén by an external sinusoi-

dal field. Primary resonances and an infinite sequence of secondary resonances have been found that can be analyzed by using Chirikov's nonlinear resonance theory. The transition threshold to global stochasticity is also estimated based on the overlap criterion. Above the threshold dynamical flows are slowed down by the presence of cantori, as clearly demonstrated by the time-dependent dissociation rates calculated for several ensembles of initial points. A scaling law is found in the vicinity of the threshold with a critical exponent in close agreement with that predicted for the standard map.

24838 **(SAND—87-2319C) Singlet oxygen behavior in solid polymer matrices.** Clough, R.L.; Iu, Kai-Kong; Dillon, M.P.; Ogilby, P.R. (Sandia National Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA). Dept. of Chemistry). 1987. Contract AC04-76DP00789. 10p. (CONF-8706276—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005171/JAW.

From Symposium on polymer photochemistry; Toronto, Canada (5 Jun 1987).

Excited states of dye molecules are efficiently quenched by molecular oxygen. This can give rise to an excited state of the oxygen molecule: singlet oxygen. Singlet oxygen has been most extensively studied in liquid organic solvents and in the gas phase. However, since oxygen is very soluble in most polymers, whenever air is present singlet oxygen could be an important participant in the photophysics and photochemistry of polymeric materials. We are studying the kinetics of both singlet oxygen and its triplet organic dye precursor in aerated, dye-containing polymers. In this report we examine differences in photophysical behavior in glassy and rubbery matrices. 8 refs., 4 figs.

24839 **Photoion—photoelectron coincidence study of $(CO)_2$.** Norwood, K.; Guo, J.; Luo, G.; Ng, C.Y. (Ames Laboratory, U.S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **88**: No. 6, 4098-4099(15 Mar 1988). Contract W-7405-ENG-82.

The photoion—photoelectron coincidence (PIPECO) spectrum for $(CO)^+_2$ has been measured in the wavelength region of ~600—1 000 A. The lower limits for the bond dissociation energies of CO^+ (X)xCO, CO^+ (A-italic-tilde)xCO, and CO^+ (B-italic-tilde)xCO are determined to be 29.8, 17, and 16 kcal/mol, respectively. Evidence supporting the existence of long-lived $(CO)^+_2$ states with dissociation lifetimes >40 μs at energies above the CO^+ (X,v = 0)+CO asymptote is found. The dissociative lifetimes of CO^+ (A-italic-tilde)xCO and CO^+(B-italic-tilde)xCO are estimated to be longer than 4 μs and 50 ns, respectively.

24840 **Production of pyrimidine dimers in DNA by an incandescent spot lamp.** Ciarrocchi, G.; Sutherland, B.M.; Sutherland, J.C. (Istituto di Genetica Biochimica ed Evoluzionistica del C.N.R., Pavia (IT)). pp 379-382 of The medical and biological effects of light. Wurtman, R.J.; Baum, M.J.; Potts, J.T. New York, NY; The N.Y. Academy of Sciences (1985). (CONF-8410211—).

From New York Academy of Science conference on medical and biological effects of light; New York, NY, USA (31 Oct 1984).

The electrophoretic analysis of circular DNA substrates exposed to specific nucleases allows the detection of very small numbers of pyrimidine dimers (PD). The authors devised two assays for this purpose. In both cases PD titration was based on the very high specificity for PD of the purified Micrococcus luteus PD endonuclease, a specific probe for the presence of such photoproducts in DNA. The first method depends on the distinct electrophoretic mobilities of supercoiled (RFI) and nicked circular duplex (FRII) DNA on neutral agarose gels. This method allows the detection of up to four PDs per molecule, but only in supercoiled DNA. The second assay depends on the distinct electrophoretic mobilities of single-stranded (ss) molecules of uniform length and smaller reaction products, obtained after digestion with the specific endonuclease. In this procedure, DNA substrates of uniform length, which may be supercoiled, partially relaxed or linear (ss or ds), are exposed to the M. luteus PD endonuclease, after which uncleaved molecules are separated from the other smaller reduction products by electrophoresis. Then the number of PDs per molecule can be expressed as a function of the number of ss molecules left intact after the specific nicking treatment. With circular substrates, the molecule is linearized by using a restriction endonuclease. This assay can detect up to eight PDs per duplex molecule. The authors developed a new biochemical assay for detecting enzymatic photoreactivation of PDs in 254 nm irradiated, nonradioactive supercoiled DNA.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 24759, 25207, 25208, 25235, 25236, 25309

24841 (CONF-8703238—, pp 297-306) **Electron ejection cross sections in electron and ion impact ionization: ab initio and semiempirical calculations.** Manson, S.T.; Miller, J.H. (Georgia State Univ., Atlanta). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Ab initio calculations of single and double differential cross sections for ionization by fast, charged particles within the framework of Born approximation are presented. In addition, a semiempirical method based on the asymptotic Bethe-Born expansion is also discussed. Both are applied to ionization of helium by electrons and protons in an effort to assess their accuracy and validity. Agreement with experiment is quite good. The implications for other targets is discussed.

24842 (CONF-8703238—, pp 307-311) **Semiempirical relationship for the total cross section for electron scattering in atoms and molecules.** Nogueira, J.C.; Chaguri, J.E. (Departamento de Quimica-UFSCar, Sao Carlos, Brazil). 1987. NTIS, PC A99/MF A01. Order Number DE88005614/JAW.

From International symposium on quantum chemistry, solid-state theory, and computational methods; Marineland, FL, USA (12 Mar 1987).

Total cross section values for electrons scattered by atoms and molecules can be obtained by adding the total inelastic cross section to the total differential elastic cross section. They compare these values with experimental values for nitrogen and carbon dioxide. For methane, they compare with experimental values from positron scattering. The agreement is excellent for nitrogen between 40 and 1500 eV and for carbon dioxide between 100 and 500 eV.

24843 **(INIS-BR—929) Neurotoxity of artificial medium of radiological constrast.** Pinheiro, R.S.A. (Sociedade Brasileira de Radiologia, Sao Paulo). 1986. 1p. (In Portuguese). (CONF-8611223—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88701743/JAW.

From 18. meeting on radiology from Rio de Janeiro; 10. meeting on radiology residents from Rio de Janeiro; Rio de Janeiro, Brazil (19 Nov 1986).

24844 **Pulse-radiolytic oxydation of diphenylamine. - pH-effects on the excited state of the radical.** Schmidt, K.H.; Bromberg, A.; Meisel, D. (Chemistry Div., Argonne National Lab., Argonne, IL 60439). pp 70 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Pulse-radiolytically produced OH radicals react with diphenylamine, phi/sub 2/NH, to yield primarily the OH-adduct to the phenyl ring. This adduct radical, however, very rapidly (<1μs) hydrolyzes to yield the anilino type radical. Rates of protonation and deprotonation of this radical were measured using the conductivity detection technique. The anilino- type radicals were excited with a laser pulse (347 nm) and the fate of the excited radicals was followed spectrophotometrically. At basic pH's the excitation seems to accelerate the thermal reaction leading to the same product as would otherwise by obtained by the acid-base equilibrium of the ground state of the radical. The results are rationalized assuming a

lower pK/sub a/ for the excited state of the radical than for its ground state.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 24119, 25141, 25142

24845 (INIS-mf—10576, pp 39) **Effect of sucrose meda on /sup 32/P labelling of phosphatidyl inositol in rat pineal gland.** Novothy, I.; Novotna, R.; Skalkova, E. (Karlova Univ., Prague, Czechoslovakia. Fakulta Vseobecneho Lekarstvi). 1985. NTIS (US Sales Only), PC A02/MF A01. Order Number DE87701460/JAW. (CONF-8504292—Absts.).

From 6. Czechoslovak biophysical congress with international participation; Bratislava, Czechoslovakia (10 Apr 1985).

24846 (Juel—2137) **Development and optimization of methods for the radiofluorination of aromatic compounds with specific, high fluorine-18 activity.** Franken, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie 1 -Nuklearchemie; Koeln Univ. (Germany, F.R.)). Jun 1987. 148p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752033/JAW.

The positron emitter fluorine-18 (T/sub 1/2/ = 110 min) is an ideal radionuclide for analogue tracers in positron emission tomography (PET). In this study the production of the electrophilic species [/sup 18/F]-F/sub 2/, [/sup 18/F]-CH/sub 3/CO/sub 2/F and to some extent [/sup 18/F]-XeF/sub 2/ has been optimized with respect to yield and specific activity. Selectivity and reactivity of these species have been studied in simple aromatic model compounds. Fluorine was produced via the /sup 20/Ne(d,α)/sup 18/F reaction. The effect of target material, dimensions, amount of carrier (F/sub 2/), pressure, beam current and irradiation time was studied. Reactivity of [/sup 18/F]-F/sub 2/ and [/sup 18/F]-CH/sub 3/CO/sub 2/F with respect to hydrogen subsitution was systematically studied in a series of benzene derivatives (C/sub 6/H/sub 5/X, X = CF/sub 3/, I, Br, CL, F, H, CH/sub 3/, OCH/sub 3/, OH) in various solvents (CHCl/sub 3/, CFCl/sub 3/, CH/sub 3/CN, CH/sub 3/OH, CF/sub 3/COOH). The radiochemical yield of /sup 18/F-for-H-substitution in the aromatic ring increased with increasing acceptor number (AN) of the solvent. The electrophilic nature of both fluorination agents was confirmed by a Hammett plot. As expected, [/sup 18/F]-CH/sub 3/CO/sub 2/F showed a higher selectivity than [/sup 18/F]-F/sub 2/. Direct radiofluorination with [/sup 18/F]-F/sub 2/ and [/sup 18/F]-CH/sub 3/CO/sub 2/F was successfully applied to the biomolecules phenylalanine, tyrosine and DOPA. As potential methods for no-carrier-added (n.c.a.) radiofluorination some less common dediazoniation reactions were also studied.

24847 (LBL—22300, pp 25-30) **Use of generator-produced ^{122}I for studies of heart and brain function.** Mathis, C.A.; Shulgin, A.T.; Moerlein, S.M.; Yano, Y.; Brennan, K.M.; Sergent, T. III; Budinger, T.F. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Divisions: Annual report 1986.

The nonavailability of useful positron emitting radionuclides for PET studies has contributed to limiting the application of this technique to a relatively few PET centers. Due to their short half-life, most positron emitting radionuclides must either be produced on-site by a cyclotron or harvested from long-lived parent radionuclides in a generator system. There are a number of positron generator systems that contain parent radionuclides whose half-lives are long enough to permit shipment from the site of production to a distant PET facility. Most of these generator systems produce metal ions such as $^{68}Ga^{+3}$, $^{82}Rb^{+}$, /sup 52m/Mn^{+2}, $^{62}Cu^{+2}$, and $^{128}Cs^{+}$, which are not ideal for incorporation into radiopharmaceuticals used to evaluate brain and heart function. We have explored the potential usefulness of the ^{122}Xe/^{122}I generator system because the half-life of the parent ^{122}Xe (20 hr) is long enough to permit shipment, and the daughter's radionuclidic chemical properties allow rapid incorporation into a variety of organic radiopharmaceuticals. In addition, the short half-life of ^{123}I (3.6 min) makes possible repeated injections in the same subject due to its rapid decay and relatively low radiation dose per injection. 4 refs., 4 figs., 1 tab.

24848 (RCM—01187) **Redox behaviour of Pu and Am in saline solutions and characterization of groundwater-colloids by laser-induced photoacoustic spectroscopy (LPAS). Interim report. Period covered: January 1 to June 30, 1987.** Kim, J.I.; Bueppelmann, K.; Klenze, R.; Lierse, C.; Stadler, S. (Technische Univ. Muenchen, Garching (Germany, F.R.). Lehrstuhl fuer Radiochemie). Jun 1987. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752264/JAW.

The paper deals with two separate subjects. The first one is the radiolytic redox behaviour of Pu and Am in NaCl as well as natural saline solutions. Through α-radiolysis Pu and Am become readily oxidized in concentrated NaCl solutions and then the oxidized species undergo reduction upon decreasing of the salinity and specific activity of solution. Primary and secondary reactions involved in the redox process are elucidated. The second subject concerns the characterization of colloids by laser induced photoacoustic spectroscopy (LPAS). Colloid effects on LPAS spectra, which are investigated using groundwaters with different colloid concentrations and Latex solutions, provide the possiblitiy of quantifiying colloid concentrations in solution.

24849 **Removal of the samarium isobaric interference from promethium mass analysis.** Shaw, R.W.; Young, J.P.; Smith, D.H. (Oak Ridge National Lab., TN). *Analytical Chemistry;* **60**: No. 3, 282-283(1 Feb 1988). Contract AC05-84OR21400.

Resonance ionization mass spectroscopy (RIMS) is used to eliminate isobaric interference when determining the isotopic abundances of an element. In this application, RIMS is applied to the determination of promethium with the removal of samarium interference. In particular, promethium-147 is separated form samarium-147 and samarium-152.

24850 **Thorium(IV) hydrous oxide solubility.** Ryan, J.L.; Rai, D. (Pacific Northwest Lab., Richland, WA). *Inorganic Chemistry;* **26**: No. 24, 4140-4142(2 Dec 1987). Contract AC06-76RL01830.

The results of a study of the solubility of amorphous, hydrous ThO_2 over the pH range 3.5 - 14.2 are reported. The solubility is high at pH 3.5 and decreases rapidly at pH 4.5. The chemical modes of solubility over various pH ranges are discussed. No conclusive evidence for any amphoteric behavior of Th(IV) is reported. 22 references, 1 figure.

24851 **Organic analyses of mixed nuclear wastes.** Toste, A.P.; Lucke, R.B.; Lechner-Fish, T.J.; Hendren, D.J.; Myers, R.B. (Pacific Northwest Lab., P.O. Box 999, Richland, WA 99352). pp 323-330 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC06-76RL01830.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Analytical methods are being developed at Battelle's Pacific Northwest Laboratory for the organic analysis of nuclear wastes. In this study the authors' laboratory analyzed the organic content of three commercial wastes and an organic-rich, complex concentrate waste. The commercial wastes contained a variety of hydrophobic and hydrophilic organics, at concentrations ranging from nanomolar to micromolar. Alkyl phenols, chelating and complexing agents, as well as their degradation products, and carboxylic acids were detected in the commercial wastes. The complex concentrate waste contained chelating and complexing agents, as well as numerous degradation products, at millimolar concentrations. To date, 75.1% of the complex concentrate waste's total organic carbon content has been identified. The presence of chelator fragments in all of the wastes analyzed, occasionally at elevated concentrations, indicates that organic diagenesis, or degradation, in nuclear wastes is both widespread and quite vigorous.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

24852 (DOE/ER/13395—2) Measurement of species concentrations in flames by laser-induced fluorescence: Progress report, January 1, 1986-December 31, 1987. Salmon, J.T.; Peterson, D.L.; Lytle, F.E.; Laurendeau, N.M. (Purdue Univ., Lafayette, IN (USA). Flame Diagnostics Lab.). Mar 1988. Contract FG02-85ER13395. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007096/JAW.

This report describes work accomplished in the last two years on measurement of species concentrations in flames via laser-induced fluorescence. During this period, we have developed a new quenching-independent method for obtaining quantitative measurements of atomic hydrogen concentration. The technique, labeled photoionization controlled-loss spectroscopy (PICLS), employs two-photon absorption followed by photoionization of the excited-state atoms. A new monochromatic temperature probe has also been developed which makes use of the anomalous fluorescence of pyrene. In this case, a local vibrational temperature can be measured using a single laser beam by monitoring the fluorescence ratio from the first and second excited states of the pyrene molecule. 20 refs., 6 figs.

24853 (DOE/ER/13439—3) Infrared absorption spectroscopy and chemical kinetics of free radicals: Progress report, 1 March 1985 to 1 February 1987. Curl, R.F.; Glass, G.P. (Rice Univ., Houston, TX (USA)). 1987. Contract FG05-85ER13439. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006536/JAW.

Infrared kinetic spectroscopy using excimer laser flash photolysis and color center laser probing has been used to measure the branching ratio of the deNOx reaction: $NH_2 + NO \rightarrow HN_2(?) + OH \rightarrow N_2 + H_2O$. The amidogen radical, NH_2, was produced by ArF photolysis of NH_3. Infrared absorptions of OH and H_2O were measured to determine the absolute contributions of the OH and H_2O product channels. Using color center laser kinetic spectroscopy to follow the time decay of C_2H transient absorption, the rate constants for the reactions of C_2H with H_2, O_2, C_2H_2, and NO have been measured. The C_2H was produced by ArF excimer (193 nm) flash photolysis of trifluoropropyne for the H_2, O_2, and NO reactions. In the case of the C_2H_2 reaction, C_2H was produced by flash photolysis of acetylene. An investigation to determine the identify of the products of the reaction between C_2H and O_2 has been initiated. Also, electronic transitions of C_2H and C_2O have been studied. New bands have been identified and rotationally analyzed. 1 tab.

24854 (DOE/ER/13544—T1) Laser spectroscopy and dynamics of combustion intermediates: Progress report, June 1, 1987-May 31, 1988. Clouthier, D.J. (Kentucky Univ., Lexington (USA). Dept. of Chemistry). Jan 1988. Contract FG05-86ER13544. 4p. NTIS, PC A02/MFA 01; 1; GPO Dep. Order Number DE88006541/JAW.

Collision-free single rotational fluorescence lifetimes have been measured for thioformaldehyde at very low pressures. Measurements are being conducted on the jet-cooled spectra of thioformaldehyde using a heated supersonic jet. Supersonic jet spectra of the S_1 reverse arrow S_0 spectrum of the transient species S_2O have been recorded using the heterogeneous reaction $SOCl_2 + Ag_2S \rightarrow S_2O + 2AgCl$ before the jet. The precursor C_3OS has been flash photolyzed, and the spectrum expected of C_2S was observed. (DLC)

24855 (UCID—21316) Numerical simulation of turbulent premixed combustion and decay of turbulent swirling flow. Cloutman, L.D. (Lawrence Livermore National Lab., CA (USA)). 27 Jan 1988. Contract W-7405-ENG-48. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006588/JAW.

We present the results of the numerical simulation of three experiments with the CONCHAS-SPRAY and KTVA hydrodynamics programs. Both codes are shown to give acceptable accuracy, although it would be desirable to improve the turbulence models and turbulent combustion rate model. 15 refs.

24856 Diffusional-thermal instability of adiabatic flame propagation in dissociation equilibrium. Chao, B.H.; Law, C.K. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-870816—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Technical Paper 87-HT-60.

Effects of product dissociation and preferential diffusion on the structure, propagation, and diffusional-thermal instability of the classical one-dimensional laminar flame have been studied by using activation energy asymptotics. Analytical expressions as functions of dissociation and diffusion parameters have been obtained for such bulk flame parameters as the flame temperature reduction and the propagation rate eigenvalue, and for the dispersion relation governing flame stability. Results on flame propagation show that while under most situations the flame speed is reduced due to product dissociation, it can attain values in excess of the nondissociative limit for highly-mobile product species which can preferentially back diffuse to the upstream portion of the reaction zone where they recombine and release the associated recombination heat. Results on flame stability show that it is promoted in the presence of product dissociation which has a moderating influence on the flame temperature fluctuations, and for high-mobile product species because of the enhanced burning rate and curvature-induced concentration modification.

42 ENGINEERING

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 24132, 24133, 24411, 24437, 24504, 24567, 24603, 24604, 24982

24857 (COAL/GE—5/R-43/Add.2) Methods of recording and monitoring the operation of mining equipment. (United Nations, Geneva (Switzerland). Economic Commission for Europe). 30 Nov 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900454/JAW.

The progress of all types of prime movers is recorded by mine operators by a weekly measurement survey of the overburden output, plant availability and utilization to ensure maximum efficiency. All plant breakdowns, their causes and associated costs are recorded and in certain instances the data is computerized for monitoring the working life of replacement parts. Failure of excavation faces and low wall backfill resulting from adverse geotechnical conditions is recorded and the causes of failure noted. The information from examination of such failures is computerized to provide a data bank for assessment of potential instability problems. Mine operators undertake a daily and weekly planned maintenance programme of all earth-moving plant and ancillary equipment to manufacturer's specification. A computerized monitoring system is under evaluation. The sensors provide the necessary signals to a processor console which records and manipulates the data to provide visual displays in the operator's cab and also shift production reports. A keyboard in the cab allows the operator to request specific visual displays and enter activity code information. Long-term production data from the Digmate Plus system is transferred to the mine office via a bubble memory cartridge which is read by a desk top reader and the data transferred to an existing office computer. In addition to monitoring, the Digmate Plus system has the ability to provide protection against boom overstress and damage. The primary protection functions performed are hoist and drag motion overtravel limits and prevention of operation which leads to a static or dynamic tightline condition resulting in bucket/boom collision.

24858 (CONF-880424—4) Range image segmentation and surface parameter extraction for a mobile robot. Goldstein, M.; Pin, F.G.; Weisbin, C.R. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87013877/JAW.

From IEEE international conference on robotics and automation; Philadelphia, PA, USA (25 Apr 1988).

This paper presents a methodology for a concise representation of the 3-D world model for a mobile robot, using range data. The process starts with the segmentation of the scene into "objects" that are given a unique label, based on principles of range continuity. Then the external surface of each object is partitioned into homogeneous surface patches. Contours of surface patches in 3-D space are identified by estimating the normal and curvature associated with each pixel. The resulting surface patches are then classified as planar, convex or concave. Since the world model uses a volumetric representation for the 3-D environment, planar surfaces are represented by thin volumetric polyhedra. Spherical and clindrical surfaces are extracted and represented by appropriate volumetric primitives. All other surfaces are represented using the boolean union of spherical volumes (as described in a separate paper by the same authors). The result is a general, concise representation of the external 3-D world, which allows for efficient and robust 3-D object recognition. 20 refs., 14 figs.

24859 **(CONF-880424—7) An efficient gradient projection optimization scheme for a seven-degree-of-freedom redundant robot with spherical wrist.** Dubey, R.V.; Euler, J.A.; Babcock, S.M. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Mechanical and Aerospace Engineering). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005440/JAW.

From IEEE international conference on robotics and automation; Philadelphia, PA, USA (25 Apr 1988).

A computationally efficient kinematic control scheme is presented for a seven-degree-of-freedom redundant robot with spherical wrist. This scheme uses a gradient projection optimization method, which eliminates the need to determine the generalized inverse of the Jacobian when solving for joint velocities for given Cartesian end-effector velocities. Closed-form solutions are obtained for joint velocities using this approach. The application of this scheme to the seven-degree-of-freedom manipulator at the Center for Engineering Systems Advanced Research (CESAR) is described. 24 refs., 7 figs., 1 tab.

24860 **(CONF-880433—3) Computer simulation of a motor pump unit to aid in interpreting vibration data.** Clapp, N.E.; Damiano, B. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004481/JAW.

From Southeastcon '88 conference and exhibit; Knoxville, TN, USA (10 Apr 1988).

While measuring vibrations to analyze rotating machinery conditions is an accepted industry practice, the amount of data required is large and time-consuming to collect. Another approach for predicting vibration signatures due to component failures or changes under operating conditions is being performed in the Instrumentation and Controls Division of the Oak Ridge National Laboratory. Using a dynamic computer model of the rotating machine, a variety of natural modes of oscillations can be simulated. Results are analyzed using a Fast Fourier Transform code to generate spectra that show changes in spectral shapes caused by the simulated anomalies. 2 refs., 7 figs.

24861 **(FA—840420) Health implications of exposure of underground mine workers to diesel exhaust emissions.** (French (Ian W.) and Associates Ltd., Markham, Ontario (Canada)). 20 Apr 1984. 611p. (MICROLOG—85-0955). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report was prepared by Ian W. French and Associates Limited. The primary purpose of this document is to critically review the relevant scientific literature describing the occupational environment to which underground miners are exposed and to evaluate the potential for this environment to adversely affect the mine worker's pulmonary function and health. In particular, emphasis is placed on the potential or real health effects of gaseous and particulate emissions resulting from the use of diesel powered equiment underground. A brief review of the mechanical and chemical aspects of diesel engines and their impact on the underground mine environment is presented.

24862 **(JAERI-M—87-165) Investigation on structural analysis computer program of spent nuclear fuel shipping cask, (2).** Yagawa, Ganki; Ikushima, Takeshi. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 174p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88752325/JAW.

This report describes the results (II) done by the Sub-Committee of Research Cooperation Committee (RC-62) of the Japan Society of Mechanical Engineers under the trust of the Japan Atomic Energy Research Institute. The principal fulfilments and accomplishments are summarized as follows: (1) Regarding the survey of structural analysis methods of spent fuel shipping cask, several documents, which explain the features and applications of the exclusive computer programs for impact analysis on the basis of 2 or 3 dimensional finite element or difference methods, were reviewed. (2) In comparative evaluation of the existing computer programs, the common benchmark test problems for drop impact of the axisymmetric cylinder and plate were adopted the calculational evaluations for taking into account the strain rate effect of material properties, effect of artificial viscosity and effect of time integration step size were carried out. (3) Evaluation of impact analysis algorithm of computer programs were conducted and the requirements for computer programs to be developed in future and an index for further studies have been clarified.

24863 **(JAERI-M—87-175) Kinematic analysis of a six-link manipulator based on vector, elementary geometry and polynomial expression.** Sasaki, Shinobu; Shinohara, Yoshikuni. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 21p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752336/JAW.

This paper is concerned with the description of relationships between links and the direct derivation of individual joint solutions using the knowledge relating vector and elementary geometry for analysing link mechanisms, in which formulation of angular displacement by means of rotational (unit) vector and simple vector arithmetics are the basic approaches. Compared with the traditional transformation method, the present advantages are to permit explicit angular solution for each joint as well as intuitive formulation. Analytical results show that they are in complete agreement with the previous results with respect to the precision or the number of solutions.

24864 **(LBL—23993) Superconducting magnet technique for ASTROMAG on the space station.** Green, M.A. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 24p. (CONF-8710241—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004560/JAW.

From International forum on scientific uses of the space station; Venice, Italy (4 Oct 1987).

This paper describes superconducting magnet systems which could be used as part of a Particle Astrophysics Experiment ASTROMAG on the space station. This report deals with issues of superconductor selection (should one consider the use of high critical temperature superconductor?), magnet coil and cryostat design, and the cryogenic cooling system for the superconducting magnet. 12 refs., 7 figs., 6 tabs.

24865 **(LHEM—791018) Report on the design, development, and initial testing of the Heato-Drill: oil fired water heater for drill hole application.** (Lochhead Haggerty Engineering and Manufacturing Co. Ltd., Burnaby, British Columbia (Canada)). 1979. 27p. (MICROLOG—82-0500). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

In the drilling operation, water is required for drill bit lubrication. Where drilling is carried out in northern areas of Canada, the problem of freezing becomes significant. To overcome this the drill water is heated. The heater systems developed for portable operation have been simple oil fired units but have had several limita-

tions. The major ones are unreliable combustion, insufficient heating capacity for larger drill requirements, awkward and bulky size. Requirements laid out for the development of a new heater were that it should meet parameters for operation and physical specifications. From the initial design considerations, the approach selected was on two aspects: ensure reliable, controlled, complete combustion, and to obtain a compact, rugged, readily transportable, and assembled unit.

24866 **(LU/C—8407) An assessment of the sulfuric acid aerosols, hydrocarbons and respirable combustible dust in the underground mine environment. Final report.** Baldisera, L.A.; Westaway, K.C. (Laurentian Univ., Sudbury, Ontario (Canada). Dept. of Chemistry). Jul 1984. 67p. (MICROLOG—85-0967). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Four different types of filters for collecting sulfuric acid mist samples and respirable combustible dust (RCD) samples in dieselized underground mines have been assessed. The silver membrane filter has been judged superior for collecting the sulfate ion and the RCD samples. The results of sulfate ion, pH, and RCD analyses show that the average sulfate ion concentration is only half of the TLV value for sulfuric acid and that very little of the sulfate ion is present as sulfuric acid at the sampling site. Very little of the sulfur compounds in the fuel can be detected in the mine environment. The results suggest that the sulfuric acid dissolves in water droplets that settle out of the mine air rapidly, and that the amount of sulfuric acid in the mine environment is far below the TLV level in nickel mines whether the diesel is fitted with a catalytic purifier, a fume diluter, a Corning diesel exhaust filter or has no exhaust treatment device. It appears that the sulfuric acid levels in the mine air are related to the amount of sulfur in the fuel. Adding a catalytic purifier to the exhaust system of the diesel reduced the amount of carbon and almost doubled the percent sulfate ion/RCD. When the Corning diesel exhaust filter was added to the diesel, the percent carbon/RCD and the percent RCD/total respirable dust were reduced. Burning a more aromatic higher sulfur fuel in the diesel increases the RCD, decreases the percent carbon and increases the amount of sulfate ion and sulfuric acid in the exhaust.

24867 **(ME/SC—83) Design of a high temperature erosion test facility. Phase 1: design. Final report.** (Montreal Engineering Co. Ltd., St. Catharines, Ontario (Canada)). 1983. 257p. (MICROLOG—83-0918). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The overall objective was to design, construct and test a transportable High Temperature Erosion Test Facility. The project was divided into three phases. The first phase, concerning the design of the facility, is the subject of this report. The detailed design was carried out by Foster Wheeler Limited. Visits were made to seven sites in the U.S.A. covering a full range of uses. However, none of the test rigs inspected had the operational flexibility to cover the range of parameters originally laid down. The draft specification was reviewed with Foster Wheeler and CANMET followed by modifications issued to Foster Wheeler. Details of the parameters, specifications, and modifications are enclosed in the Appendices.

24868 **(NP—8770109) Operational load on pipeline systems. Report No. 2. Final report of part project A 2.** Brumm, J. (Hannover Univ. (Germany, F.R.). Sonderforschungsbereich 211 - Zeitabhaengige Vorgaenge und Schadenserkennung in Komponenten Waermetechnischer Anlagen). 1986. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770109/JAW.

In pipeline, shut-on and shut-off of pumps and control elements causes sudden pressure shocks which must be taken into account in dimensioning. The authors investigated the effects of fluid-structure interactions on the extent and propagation of the pressure shocks.

24869 **(PCSM/EA—8512) Use of injection wells at PCS Mining for disposing of waste potash brine. Final report.** McLaughlin, G.; Reid, K.W. (Keen Engineering Co. Ltd., West Vancouver, British Columbia (Canada)). Dec 1985. 37p. (MICROLOG—86-05102). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Potash mines in Saskatchewan are required to use injection wells to dispose of excess brine. The most common problems with injection wells are packer failure, leaks developing in the injection tubes, and gradual decrease of assimilative capacity. Acidizing has been used to improve well performance, and may be an effective remedial measure for wells injecting into carbonate formations. Wells may suffer less obstructions if they are allowed to drain completely upon being shut down. Wells might be more effective if more consideration was given to the site geology when locating. The most cost effective well design appears to be the open hole type whereby both the outer casing and injection tubes stop at the top of the injection zone. These wells are less expensive to construct and rehabilitate. 4 figs.

24870 **(PFC/CP—87-22) Tethered diagnostic package for use from the Space Station.** Sullivan, J.D.; Post, R.S.; Irby, J.H.; Lorenzini, E.C. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center; Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). 1987. Contract AC02-78ET51013. 10p. (CONF-8710207—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006264/JAW.

From 2. international conference on tethers in space; Venice, Italy (6 Oct 1987).

The interaction in the upper ionosphere between the ambient medium and Space Station or other orbiting vehicles in the 1990s will require measurements from essentially non-intrusive instrumentation and the ability to repeat those measurements at will in an extended region about a space vehicle. A diagnostic package on a line, a "spin-cast" diagnostic package (SCDP), can complement free flyers and attached instrumentation in the region from 10 m to 1 Km. The basic concept for the SCDP is to cast off, probably electro-magnetically, on a fiber optic line in some chosen direction a small, battery powered, instrumentation package and then to reel it back in while making measurements. The SCDP instrumentation package could have interchangeable sensors or transducers; a typical package might include pressure monitors, various plasma probes, magnetometers, plasma wave, and optical sensors which could include video imaging. The dynamics of deployment and retrieval maneuvers of the SCDP is analyzed. Strategies for casting the package in any given direction from the Space Station are devised. Fast, impulsive retrieval maneuvers with negligible tension in the tether are also investigated. A preliminary design of the subsystems necessary for the spin-casting and recovery of the SCDP is also presented in the paper.

24871 **(SAND—87-1942C) Insertions using geometric analysis and hybrid force-position control: Method and analysis.** Strip, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 14 Sep 1987. Contract AC04-76DP00789. 16p. (CONF-880424—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87013652/JAW.

From IEEE international conference on robotics and automation; Philadelphia, PA, USA (25 Apr 1988).

Automatic programming of insertions is an essential step in achieving a truly flexible manufacturing environment. We present techniques based on active compliance implemented with hybrid force-position control which are capable of inserting a wide variety of shaped pegs. We analyze the forces encountered during the insertions to determine what classes of shapes these techniques will consistently insert. The analysis also gives guidance in selecting parameters of these techniques for specific shapes. These techniques provide a significant step towards an automatically programmed flexible manufacturing environment. 9 refs., 7 figs.

24872 (SAND—88-0562C) Human interfaces in remote driving. McGovern, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 33p. (CONF-880359—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006843/JAW.

From IGC conference; Bedford, MA, USA (20 Mar 1988).

Driving vehicles through remote control (teleoperation) can allow the human operator to take actions at a distance. Human effectiveness can be projected into locations which may be hazardous. In order for the operator to control the motion of these vehicles, knowledge of the vehicle environment and status need to be available. This requires a system consisting of vehicle, communication link and human operator. Much work has been done in vehicle and communication system design but comparatively little effort has been devoted to the human interface. In this paper, experimental studies of remote driving are reviewed to approach an understanding of what is known. Summary data are presented for experimental work performed at Sandia National Laboratories in vehicle vision systems. This information is combined with the experience base developed through several years of work with teleoperated vehicles to identify the major areas requiring additional development effort. 14 figs., 2 tabs.

24873 (SCSIN—U-1-3-C-84) Rules for preventing criticality in nuclear facilities (Power reactors excluded). (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Oct 1984. 14p. (In French). (SIN—5824-84). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752186/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analysises and the clear understanding between persons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem this necessary, while specifying the applicability conditions. The present rule defines the dispositions to take in account for avoid criticality in nuclear facilities. Are excluded facilities in which the U235 ratio is less or equal at 1 % when this uranium is not in a moderating matrix.

24874 (SCSIN—U-1-4-A-85) Rules for preventing chemical risks: fire protection. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Feb 1985. 27p. (In French). (SIN—A-1265-85). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752185/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analysises and the clear understanding between persons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem, this necessary, while specifying the applicability conditions. The present rule defines the dispositions to take in account for avoid fire hazards in nuclear facilities (Power reactors and accelerators are excluded).

24875 (TS—23440/0/9169) Ultrasonic monitoring of crack extension by corrosion fatigue in oil pipelines. Final report. Maceck, M. (Techno Scientific, Downeview, Ontario (Canada)). Feb 1982. 49p. (MICROLOG—83-0052). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report deals with the ultasonic monitoring of crack extension by corrosion fatigue in oil pipelines. The overall objective was to determine the initial acceptable defect sizes for representative operational conditions. The project includes the study of pressure spectrum, effect of crack orientation, effect of H/sub 2/S content, fracture mechanics calculations of corrosion fatigue lives and verification of predicted corrosion fatigue lives by field experiments using artificial weld toe defects. The report describes the full-scale experiments performed to test the fatigue lives as predicted by the laboratory work. The ultrasonic dynamic time of flight method was used to measure the depth of cracks. An automated computer controlled system gives near real time results and graphically displays crack profiles to an accuracy of 0.5 mm. Three full scale pipe sections were tested. The measure fatigue lives were shorter than those predicted. The critical crack length leading to a leak was also established. Crack morphology was verified by fractography and metallography. Data generated were used to define allowable crack depth for the remaining life of the pipeline.

24876 (UCRL—98108) Synthesis of metastable superconductors by high dynamic pressure. Nellis, W.J.; Maple, M.B.; Geballe, T.H. (Lawrence Livermore National Lab., CA (USA); California Univ., San Diego, La Jolla (USA); Stanford Univ., CA (USA)). Jan 1988. Contract FG03-86ER45230;W-7405-ENG-48. 10p. (CONF-880110—22). NTIS, PC A02. Order Number DE88005620/JAW.

From SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering; Los Angeles, CA, USA (10 Jan 1988).

High dynamic pressure is used to synthesize metastable superconducting materials and to process superconductors into practical form. Specimens are subjected to shock pressures in the range 0.1-1 Mbar, temperatures up to several 1000 K and quenches at rates up to 10^{12} bar/s and 10^{9} K/s. Shock waves are generated by impact of projectiles accelerated up to 3.5 km/s by the LLNL two-stage light-gas gun. Recovered specimens are characterized for superconductivity and structural properties. The gas gun, specimen recovery fixture, and phenomenology of the technique are described. Results are reviewed and include a quenched solid-solid phase transition (A15 Nb_3Si); amorphous, fine-grained, and multiphase materials produced by shock-induced melting of powders and subsequent rapid solidification; and the shock-compaction in a metal matrix of thin powder layers of high-T/sub c/ oxides mixed with metal. The latter is a potential method for fabricating superconducting wire, which could be scaled to long lengths using explosives. 25 refs., 10 figs.

24877 (WIC—820723) State of the art review of NDE technique for on-line inspection of pipelines for subcritical cracks. Final report. Macecek, M. (Welding Inst. of Canada, Oakville, Ontario (Canada)). 23 Jul 1982. 76p. (MICROLOG—83-2283). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report provides a state of the art review of the methods applicable to measuring subcritical flaws in pipelines. The statistical survey shows that field failures are caused almost entirely by external factors; only about 20% can be attributed to material and weld defects. The economic penalty for a failure may be high because of the downtime of the system. The survey describes in detail the available literature, opinions, and experiences of some workers in the oil and gas industries, and indicates areas that require additional research. 11 figs.

24878 **Rf properties of an oxide-superconductor half-wave resonant line.** Delayen, J.R.; Goretta, K.C.; Poeppel, R.B.; Shepard, K.W. (Engineering Division, Argonne National Laboratory, Argonne, Illinois 60439). *Applied Physics Letters;* **52**: No. 11, 930-932(14 Mar 1988). Contract W-31-109-ENG-38.

Cylindrical rods of YBa$_2$Cu$_3$O/sub 7-//sub δ/ from 0.6 to 1.9 mm in diameter and up to 565 mm long have been used as the center conductor of a half-wave resonant coaxial line. The resonant line can be immersed in liquid nitrogen, which provides excellent cooling of the current-carrying superconducting surface, even in the presence of substantial rf losses. Such superconducting resonant lines have been operated at frequencies of a few hundred MHz and at rf surface magnetic fields up to 150 G at 77 K.

24879 **Effect of dissipation on thermal activation in an underdamped Josephson junction: First evidence of a transition between different damping regimes.** Silvestrini, P.; Pagano, S.; Cristiano, R.; Liengme, O.; Gray, K.E. (Istituto di Cibernetica del Consiglio Nazionale delle Richerche, 80072 Arco Felice, Naples, Italy). *Physical Review Letters;* **60**: No. 9, 844-847(29 Feb 1988).

Measurements of the lifetime of the zero-voltage state in a single hysteretic Josephson junction show clear evidence of two different damping regimes. Results are obtained for a wide range of damping within the underdamped region because the damping resistance depends exponentially on inverse temperature as does the junction's quasiparticle resistance. Thus a further insight is also given on the thorny problem of the damping resistance for the resistively shunted junction model.

24880 **The importance of high injection velocity to reduce plasma armature growth and drag in hypervelocity railguns.** Hawke, R.S.; Dixon, W.R.; Kang, S.W.; McCallen, R.C.; Susoeff, A.R.; Asay, J.R.; Shaninpoor, M. (Lawrence Livermore National Lab., Livermore, CA). pp 86 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—). Contract AC04-76DP00789;W-7405-ENG-48.

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

Plasmas are required to serve as armature in hypervelocity railguns. Typically, the plasmas are at temperatures of about 20-30,000 K and result in a high heat flux on the barrel wall. Slow moving plasmas radiate heat and melt the launcher wall causing it to ablate and resulting in a growth of the armature mass and length. As the velocity increases, the more massive and longer armature will result in greater viscous drag and ultimately limit the maximum achievable velocity. Several possible means of reducing the armature growth are possible. This paper discusses two of them, use of heat resistant barrel materials, and reduction of wall heating by reduction of exposure time through use of a high initial velocity. A summary of experimentally based, material ablation resistance calculations is presented. Second, the benefit of high injection velocity is evaluated. Finally, a joint SNLA and LLNL railgun research project based on the above considerations are described.

4203 Lasers

REFER ALSO TO CITATION(S) 24695, 25642

24881 **(LA-UR—88-51) Extension of free-electron lasers into the extreme ultraviolet.** Newman, B.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 22p. (CONF-880164—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005373/JAW.

From Free-electron laser: critical review of technology; Los Angeles, CA, USA (11 Jan 1988).

Encouraged by experimental operation of free-electron lasers in the visible to far-infrared, several research centers are now designing and/or building devices to extend into the vacuum-ultraviolet and soft x-ray regions below 100 nm, collectively referred to as the extreme ultraviolet. Here the peak- and average-power output of FEL oscillators and amplifiers should surpass the capabilities of any existing, continuously tunable photon sources by many orders of magnitude. These devices are certain to greatly enhance the future research capabilities of a number of scientific disciplines and industrial applications beyond those possible with synchrotron light sources. We review the features and output parameters of several of these active or proposed programs and the technological challenges that must be met to guarantee their success. 64 refs., 14 figs., 6 tabs.

24882 **(LA-UR—88-656) Discharge excitation of the XeF C to A transition.** Sze, R.C.; Greene, D.P.; Bigio, I.J.; Shay, T.M.; McCown, A.W.; Figueira, J.F.; Smith, P.; Vannini, M.; Sauerbrey, R.; Tittel, F.K. (Los Alamos National Lab., NM (USA); Saint Andrews Univ. (UK); Consiglio Nazionale delle Ricerche, Florence (Italy). Lab. di Elettronica Quantistica; Rice Univ., Houston, TX (USA)). 1987. Contract W-7405-ENG-36. 5p. (CONF-871254—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006448/JAW.

From Lasers '87; Lake Tahoe, NV, USA (7 Dec 1987).

Recent success in high efficiency and high energy laser extraction of tunable radiation in the blue-green C-A transition of XeF under intense, short-pulse electron beam excitation has renewed interest in the possibility of similar performance in avalanche discharges. We present preliminary results of discharge excited fluorescence studies in a variety of devices having different degrees of energy loading.

24883 **(UCID—21299) Effect of off-axis radiation in amplified spontaneous emission.** Wainwright, T. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007001/JAW.

Experiments involving amplified spontaneous emission in long, narrow structures are central to the development of x-ray laser schemes. The Fresnel number is quite large in the structures of interest so it is expected that diffraction effects will not be dominant, and consequently, ray tracing is commonly used in calculations of out-put intensity. If the laser has sufficiently high gain the intensity can reach the saturation level beyond which the individual rays no longer grow independently but compete with each other. The degree of saturation depends on the sum of all the ray intensities at any location so it is necessary to include all the ray directions which make appreciable contributions. Very simple results can be obtained if it is assumed that the rays that do not traverse the entire length of the lasing medium can be ignored. In this report we shall explore the consequences of that assumption. 2 figs.

24884 **(UCRL—97674) Surface-emitting two-dimensional laser diode arrays constructed on zig-zag heat sink surface.** Sheem, S.K. (Lawrence Livermore National Lab., CA (USA)). Dec 1987. Contract W-7405-ENG-48. 10p. (CONF-880402—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005215/JAW.

From CLEO '88: OSA/IEEE conference on lasers and electro-optics; Anaheim, CA, USA (25 Apr 1988).

A novel scheme is devised to construct two-dimensional surface-emitting laser diode arrays, in which one-dimensional laser bars are mounted on heat sink substrate having zig-zag surface contour. 5 refs., 3 figs.

24885 **(UCRL—98009) Excited state absorption of Sm^{2+} in SrF_2.** Payne, S.A.; Chase, L.L.; Krupke, W.F. (Lawrence Livermore National Lab., CA (USA)). 21 Jan 1988. Contract W-7405-ENG-48. 6p. (CONF-871147—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005725/JAW.

From 3. international laser science conference; Atlantic City, NJ, USA (1 Nov 1987).

The excited state absorption spectrum of Sm^{2+} in SrF_2 has been observed. The absorption peaks associated with the $^5D_0(4f^6)$ excited state were found to be displaced by approximately 3000 cm^{-1} from the absorption bands arising from the $^7F_0(4f^6)$ ground state (after taking the $^5D_0$-$^7F_0$ energy separation into account). The observed peak separation is ascribed to the 4f-5d exchange interaction. From the measured peak positions, the exchange energy for

the Sm^{2+} impurity was determined to be about the same order of magnitude as expected for the free ion. The implications of the properties of the excited state absorption bands for the performance of the $SrF_2:Sm^{2+}$ laser are considered. 15 refs., 2 figs.

24886 Auger-pumped short-wavelength lasers in xenon and krypton. Kapteyn, H.C.; Falcone, R.W. (Department of Physics, University of California, Berkeley, Berkeley, California 94720). *Physical Review [Section] A: General Physics;* **37**: No. 6, 2033-2038(15 Mar 1988).

We report studies of new short-wavelength lasers in xenon at 108.9 nm and krypton at 90.7 nm. The lasers are pumped by photoionization of inner-shell electrons followed by Auger decay into excited states. Experiments include measurement of gain and the lifetimes and quenching of the lasing states, the use of a mirror for multipass gain, and studies of the output pulse duration. Numerical simulations which predict gain and the time evolution of the laser output are compared with experiment.

24887 Calculation and design of a Ni-like Eu soft-x-ray laser. Maxon, S.; Hagelstein, P.; MacGowan, B.; London, R.; Rosen, M.; Scofield, J.; Dalhed, S.; Chen, M. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **37**: No. 6, 2227-2230(15 Mar 1988). Contract W-7405-ENG-48.

Numerical calculations of laser-irradiated EuF_3 targets predict gain coefficients of 0.3—1.6 cm/sup -1/ on several 4d-4p Ni-like Eu lines from 66 to 104.5 A. Dielectronic recombination is important both in determining the ionization balance and in populating the J = 1,2 4d excited states. Targets which are optimized for 0-1 gain show significantly less effect due to trapping on the 0-1 line than on the 2-1 line.

24888 Picosecond gain dynamics in KrF amplifiers. Taylor, A.J.; Gibson, R.B.; Roberts, J.P. (Los Alamos National Laboratory, Group CLS-5, Los Alamos, New Mexico 87545). *Applied Physics Letters;* **52**: No. 10, 773-775(7 Mar 1988).

The steady-state and dynamic gain characteristics in a KrF amplifier are studied with the use of 1 ps pulses. A saturation energy density in the range 1.8—2.0 +- 0.2 mJ/cm^2 is measured. The recovery of the small-signal gain coefficient exhibits two recovery processes with time constants of 67 +- 10 ps and 2.0 +- 0.2 ns.

24889 Scaling of Ne-like x-ray laser schemes to short wavelength. Rosen, M.D.; London, R.A.; Hagelstein, P.L. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **31**: No. 3, 666-670(Mar 1988). Contract W-7405-ENG-48.

The driver and target parameters required to extend the successful results from an exploding foil Ne-like-Se soft x-ray laser at 206 A towards wavelengths of 40 A are investigated. The power requirements are found to scale as λ^{-4}, which is quite costly. The principal constraint is the refraction of the x-ray laser beam in these high density, single pass, exploding foil targets. Correcting mirrors or nonrefracting target designs could reduce this costly scaling.

24890 An evaluation of heat pipe radiators incorporating pumped liquid return. Woloshun, K.A.; Merrigan, M.A. (Los Alamos National Lab., Los Alamos, NM). pp 235-240 of Proceedings of the 22nd intersociety energy conversion engineering conference. New York, NY; American Institute Aeronaut and Astronaut (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Technical Paper 879287.

The capillary power limit encountered in long heat pipes for high-power, high-temperature heat rejection by radiation to space may be exceeded by incorporating external electromagnetic force pumps for enhanced liquid return. The hydrodynamic performance of capillary pumped heat pipes is compared with externally pumped heat pipes. Practical problems incurred with pump utilization are discussed. It is concluded that heat pipe radiator performance could be enhanced through external pumping under certain conditions, but, in general, power throughput requirements could be more readily achieved by other design changes. Pump implementation problems, including the required additional mass of the pumps, increased required radiator surface area for pump attachment, pump control requirements and pump power supply, are also discussed and evaluated.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 24380, 24382, 24938, 25501, 25512

24891 (CEA-CONF—8921) Energy conversion in space. Particular application of gas cycles. Tilliette, Z.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Dec 1986. 15p. (In French). (CONF-8612127—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752173/JAW.

From SFI meeting on complex and associated thermodynamic cycles; Paris, France (10 Dec 1986).

Energy conversion for future space power facilities are highly temperature dependent for heat rejection that can be effected only by radiative transfer. The Brayton cycle is one of the solutions. It has been developed in the USA for nearly 20 years. In France it is now studied for preliminary studies based on nuclear heat source systems. It is briefly presented, some characteristics are given. Present studies of the American space power facility give a concrete example of application.

24892 (CEA-DRNR—346) Penetration of a horizontal gas jet submerged in a liquid. Carreau, J.L.; Roger, F.; Loukarfi, L.; Gbahoue, L.; Hobbes, Ph. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Aug 1986. 6p. (CONF-860810—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752172/JAW.

From Intersociety energy conversion engineering conference; San Diego, CA, USA (25 Aug 1986).

Results concerning the form of horizontal nitrogen sonic jets in water are presented. The mean value of the jet angle obtained by photography and by sampling probe is equal to 25/sup 0/. The length of penetration can be calculated with good accuracy. We have developed an unidimensional two-phase model, with slip ratio, which gives a fair account of the evolution of the jet mean trajectory, and this for Froude numbers modified to about 10/sup 5/.

24893 (CEA-DRNR-P—351) Noise and erosion of self resonating cavitating jets. Courbiere, P.; Chahine, G.L. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Sep 1986. 23p. (CONF-8609211—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752169/JAW.

From 8. international symposium on jet cutting technology; Durham, UK (9 Sep 1986).

Self resonating jets have been developed which take advantage of the natural tendency of a jet to organize in large structures. Tests have shown that these jets are both highly erosive and a source of a discrete frequency high level noise. The erosion and noise effects are harnessed for improved cutting, drilling, and cleaning, as well as for sound generation. Simultaneous investigations of the noise and erosion of these jets have been conducted and have shown a definite trend toward correlation. For instance, time evolution of volume removal rates of an impacted surface and RSM readings of a transducer have been found to be correlated. Similarly, shifts in the relative importance of the various frequencies have followed the advancement of erosion. These results could be of great advantage in the determination of the evolution of a jet cutting operation in progress. In this paper, jet noise and erosion correlation tests will be described and the results analysed.

24894 (CLM-R—279) Multiphase flow simulations of shocks and detonations: Part 1. Mathematical formulation and shocks. Fletcher, D.F.; Thyagaraja, A. (UKAEA Culham Lab., Abingdon). Sep 1987. 24p. H.M. Stationery Office, London, price Pound 5.00.

In this paper we describe a transient one-dimensional model of fluid dynamics based on the solution of multiphase flow equations. The model includes the provision for one fluid to be converted into another by a 'combustion' process. We present a comparison of the results from the present model with those from our earlier work, using a multi-gas formulation of the conservation equations, for the problem of two different gases in a shock tube. Agreement is shown to be excellent if the two species have the same velocity and temperature. If this is not the case the two approaches can give very different results. We discuss the fundamental differences between the two models and argue that it is the multiphase flow model which is more appropriate for the study of steam explosions.

24895 (EUR—9819) Improvement of heat transfers in circulating fluidized beds. Chrysostome, G.; Marcellin, M.; Large, J.F.; Molodtsof, Y. (Commission of the European Communities, Luxembourg). 1985. 67p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752378/JAW.

The research concerns the study and improvement of heat transfers in circulating fluidized beds. The factors of complete heat transfer between fluidized beds, made up of particles of variable granulometry, and verticle tubes finned lengthwise were measured at temperatures corresponding to normal combustion temperatures. The concentration of particles and the speed of the fluidized bed were varied. The rectangular section, height, and thickness of the fins on the tubes are also variables; they are either two or twenty in number and in the latter case they may be perforated. The gain in heat transfer is considerable. It was established that the real transfer of heat decreases when the height of the fins increases or when their spacing is diminished, this being due to the braking of the movement of the particles. The collected data are directly exploitable for the dimensioning of industrial units.

24896 (GKSS—87/E/25) Critical heat flux measurements in small-diameter tubes using R12 as model fluid. Mueller-Menzel, T. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik; GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Anlagentechnik). 1987. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752014/JAW.

Results of critical heat flux measurements are reported for vertical upflow of Refrigerant 12 at high mass fluxes and high pressures in small diameter tubes. The data are transformed into water data using a scaling law, which is verified by means of a new analysis. An error estimation includes the error of the scaling law. Special phenomena ('limiting quality', 'upstream boiling crisis') are explained by theoretical models. The applicability of existing correlations is checked and a new CHF-table for small diameter tubes is presented. With 41 figs., 12 tabs..

24897 (IC—86/364) Nonlinear equation of state effects and the momentum-dilution trade-off in a turbulent buoyant jet. Ponce, T.C. (International Centre for Theoretical Physics, Trieste (Italy)). May 1987. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701839/JAW.

This paper presents the results of an investigation aimed at determining the effects of using a nonlinear equation of state (instead of a linearized one) in a mathematical model of an axisymmetric turbulent buoyant jet in a neutrally stratified ambient. It also seeks to establish criteria to determine whether a linear or nonlinear equation of state should be used in the numerical modelling of axisymmetric turbulent buoyant jets in a stagnant neutrally stratified ambient. The fluid flow equations derived for the fully developed flow field of a round turbulent buoyant jet, together with the nonlinear equations of state corresponding to various types of jets (e.g. hot water jets, hot air jets, saline water jets), are solved. The numerical solutions are compared to that of a similar jet model that uses a linearized equation of state in order to arrive at guidelines in using a linearized or nonlinear equation of state. These guidelines involve (a) the fluid medium to be used, (b) the property of the jet that gives rise to the buoyancy (e.g. temperature differences, concentration differences, etc.) and (c) the initial density parameter, d/ sub O/. The nonlinear equation of state is then applied to a hot water buoyant jet model to see whether the momentum-dilution trade-off observed in fitting the prediction of a hot water jet model using a linearized equation of state to the data would be diminished. Results show that a nonlinear equation of state greatly improves the data fitting process. (author). 10 refs, 11 figs, 2 tabs.

24898 (IKE—2-65) Entrapment investigations of water-droplet behavior in a hot tin melt with varying discharge velocities and orifices. Froehlich, G.; Mueller, K. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Oct 1983. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752650/JAW.

Experiments were performed in which water was pressed through a thermally isolated tube into a clyindrical crucible (diameter 5 cm, height 7,5 cm both measured inside) filled with molten tin (600 K). The diameter of the circular water outlet was varied from 0.5 up to 10 mm and the discharge velocity of the water was in the range of 0.05 up to 20 m/s. In the tin melt the water divides into single drops, which emerged on the melt surface, if an interaction between water and tin melt did not occur. The probability for an interaction increased in experiments with higher discharge velocities of the water and smaller diameters of the water outlet. In experiments with discharge velocities $\geqq$ 5 m/s and outlet diameters $\leqq$ 2 mm one or more interactions occured in each case. At these interactions of water drops entrapped in the tin melt (called entrapment interactions) a portion of the melt was ejected from the crucible. The moment of the interaction and the pulse of the force toward the crucible bottom were recorded.

24899 (IKE—2-73) Description of the heating and expansion process of a water drop enclosed in a hot melt. Froehlich, G.; Berg, E. von. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Nov 1985. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752651/JAW.

In the present study a simple model for the description of the heating- and expansion-process of a water drop enclosed in hot melt is developed. The model is valid between the first contact of melt and water up to the beginning of evaporation. A possible superheating by retardation of ebullition is disregarded. The balance equations for energy, mass and momentum as well as the equation of state are integrated over the radial space coordinate in both media using appropriate profiles of temperature, pressure and velocity. Thereby a system of coupled ordinary differential equations is formed for the variables of the model which are now time dependent only. The equations are solved numerically by means of a FORTRAN-program. The influence of parameters (melt-temperature, heat-transfer-coefficient between melt and water as well as drop radius) are studied. It is shown that always very rapidly a vapor-layer forms around the water drop, while the inner part of the drop did not yet 'notice' anything of the heating process. An approximation formula for the time-transfer-coefficients between melt and water. Due to this approximation, the time up to incipience of evaporation grows proportional to the drop radius, which means that in the frame of the present model even small droplets won't evaporate as a whole instantaneously.

24900 (IKE—2-81) Multijet investigations with tin melt. Froehlich, G.; Konopa, H.; Bayer, V. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). May 1987. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752652/JAW.

In the experiments which are described in this paper, several jets or chains of drops by hot tin melt were side by side brought into a container filled with water, so that the melt formed a plane in the water. By the ignition of an underwater bridgewire explosion an interaction was triggered at that jet, which was nearest to the explosion centre. Under suitable conditions this interaction leaped

over to neighbouring jets and reached even the most distant jet, when not stopped before. The propagation could be recorded by a high speed camera. The records showed, that the interactions propagated in special directions and the velocity of the propagation was in a range of 2 to 8 m/s. The position of the drops and their distance to each other is very important for the propagation. By separating the single melt jets with fixed copper plats, it could be showed, that hydrodynamic effects are not responsible for the propagation of the interactions. Shock waves, resulting from the interaction cycles, are the cause for the propagation of the interactions.

24901 **(LA-UR—88-633) The turbulent heat flux in low Mach number flows with large density variations.** O'Rourke, P.J.; Collins, L.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 19p. (CONF-880250—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006445/JAW.

From Transport processes in dispersed two-phase flows with applications to propulsion systems; Huntsville, AL, USA (25 Feb 1988).

A transport equation has been derived which is the difference between the volume- and mass-averaged velocities and is simply related to the turbulent heat flux phi/sup h/. Using this equation and an assumption analogous to the drift flux approximation of two-phase flow modeling, an algebraic closure relation for phi/sup h/ that exhibits fluxes due to directed transport proportional to -del anti p and due to gradient transport proportional to -del Tau has been obtained. Much work remains to be done before the model can be used in predictive calculations of low Mach number flows with large density variations. The transport equation involves an additional scalar b that is a measure of the density fluctuations. An equation for b must be derived and terms in it modeled. We hope to use the transport equation and b-equation in conjunction with a k - anti ϵ turbulence model. The k- and anti ϵ- equations must be reexamined to see that modifications are needed when the flows have large density variations. When mass transport is important, such as in many combustion problems, expressions for the turbulent mass flux must be developed.

24902 **(NP—8770079) Effects of high free-flow turbulence, intensive cooling, and wake on the external heat transfer of a gas turbine blade with external heat transfer.** Schulz, A.V. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). 18 Apr 1986. 168p. (In German). NTIS (US Sales Only), PC A08. Order Number DE88770079/JAW.

The effects of free flow turbulence on the heat transfer characteristics of a gas turbine blade with convective cooling are investigated in hot-gas conditions, making a rigid distribution between isotropic turbulence and the free laminar turbulence of a wake flow. The influence of different Reynolds numbers of the grid flow and of different degrees of surface cooling is determined by means of heat transfer experiments with isotropic turbulence generated by quadratic grids. Experimental heat transfer data are compared with the results of a difference boundary layer calculation. The free flow turbulence is determined by laser doppler anemometry while the temperature field is calculated by a finite element method with experimentally determined boundary conditions. Another factor investigated was the effect of a wake on the heat transfer along the blade surface. A turbulent wake was simulated and discussed. (HAG).

24903 **Measurements of pressure drop in turbulent pipe flows of highly loaded HDPE slurries.** Choi, U.S.; Kasza, K.E. (Materials and Components Technology Div., Argonne National Lab., 9700 South Cass Avenue, Argonne, IL 60439). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—). Contract W-31-109-ENG-38.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Argonne National Laboratory, under sponsorship of the U.S. Department of Energy, is developing advanced energy transmission fluids for improving thermal system performance. The efforts are based on two concepts; friction reduction additives and phase change particles. These fluids are then comprised of the phase change particles, friction reduction additive, and carrier fluid. Some of the important technical issues that hinder implementation of the advanced energy transmission fluids concept are (i) the possibility of significant increase in the pumping power required to move highly loaded slurries, and (ii) the feasibility of using friction reduction additives with phase change slurries. This experimental study leads to conclusions that are essential to the development of advanced energy transmission fluids for DHC applications: (i) pressure drop penalty is negligible in turbulent pipe flows of highly loaded HDPE slurries and (ii) a friction reduction additive can be successfully combined with a phase change slurry for significant pressure reduction in DHC systems. The practicality of using highly loaded particle/liquid slurries relative to such matters as pumpability, heat exchanger performance, valve controllability, flow blockage, pressure drops in pipe fittings, etc. needs to be explored.

24904 **Development of advanced energy transmission fluids.** Kasza, K.E.; Choi, U.S.; Kaminsky, J. (Materials and Components Technology Div., Argonne National Lab., 9700 South Cass Avenue, Argonne, IL 60439). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—). Contract W-31-109-ENG-38.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

The DHC system being studied by the U.S. Department of Energy are frequently comprised of long runs of piping (sometimes miles in length) which convey the working fluid (in the heating or cooling mode) between the heat sources and sinks of the system. Furthermore, these systems often operate with small temperature differences, so that large volumes of fluid must be pumped and large heat exchangers must be used to satisfy load demands. If the pressure drop or frictional losses associated with pumping these fluids and hence the pumping power can be reduced significantly and the heat transfer occurring at the heat exchangers and the energy per pound of circulating fluid can be increased, cost reductions in the operation of these systems can be realized. These reductions can also manifest themselves in the form of upfront capital equipment cost reductions through the use of smaller pipes, pumps, heat exchangers and storage tanks when new DHC system designs employing the improved energy transmission fluids are utilized. These fluids also hold promise of improving the performance of existing systems (i.e., retrofit). The efforts to develop improved transmission fluids are based on an ANL feasibility study connected in FY-85 which highlighted two concepts and on earlier ANL studies associated with the use of phase change slurries as the working fluid in thermal systems in general.

24905 **Calculation of local bed to wall heat transfer in a fluidized-bed.** Kilkis, B.I. (Middle East Technical Univ., Inonu Bulvari, Ankara). pp 1-2 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—).

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Surface to bed heat transfer in a fluidized-bed largely depends upon its local and global hydrodynamical behavior including particle velocity, particle trajectory, gas velocity, and void fraction. In this study, a computer program was developed in order to calculate the local bed to wall heat transfer, by accounting for the local and global instantaneous hydrodynamics of the bed. This is accomplished by utilizing the CHEMFLUB computer program. This information at a given location is interpreted so that the most appropriate heat transfer model is utilized for each time increment. These instantaneous heat transfer coefficient for the given location. Repeating the procedure for different locations, a space average heat

transfer coefficient is also calculated. This report briefly summarizes the various heat transfer models employed and gives sample computer results reporting the case study for Mickley - Trilling's experimental set-up. Comparisons with available experimental data and correlations are also provided in order to compare and evaluate the computer results.

24906 **Thermal analysis on the electric cylindrical test heater for heat transfer experiments.** Chyu, M.C. New York, NY; American Society of Mechanical Engineers (1987). 11p. (CONF-870816—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Technical Paper 87-HT-44.

Issues with regard to the design, correction of data, and performance are dealt with for a cylindrical test heater prepared by inserting an electric cartridge heater into a hollow cylinder. The first part of the study presents a quantitative rule for the design of a test heater providing the most uniform boundary condition for heat transfer experiments. The second part investigates the effect of inactive zones in existence in the inserted cartridge heater on temperature and heat flux distributions based on conduction analysis. Finally, the problem of uneven heating generated by the cartridge heater is treated in the third part of this study. A method is proposed to detect the degree of uneven heating, and formulas are derived to assess its influence to the boundary condition of the test cylinder during a heat transfer experiment.

24907 **Condensation of steam on the underside of a horizontal surface in the presence of air and helium.** Stein, R.P.; Cho, D.H.; Lambert, G.A. New York, NY; American Society of Mechanical Engineers (1987). 7p. (CONF-870816—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Technical Paper 87-HT 31.

Experiments and data analysis for the condensation of steam on the underside of a horizontal surface in a closed vessel are described. Previously reported results for film condensation with air as a noncondensable gas are reviewed and compared with new data with helium as the noncondensable in the same apparatus. Observations, including photographs of the condensate configurations, related to the occurrence of dropwise condensation are also discussed. It is noted that data reproducibility over long periods of time were possible only with film condensation and that with dropwise condensation condensing surface temperatures exhibited large nonuniformities and random fluctuations with time. The well known mass transfer calculational model for accounting for the presence of noncondensable gases had been shown previously to be successful with air. The same model when applied to the helium data was not successful except for small gas contents. It appears that the suppression of convection that would be expected to occur with the less dense gas is counteracted by convection induced by fog or mist formation.

24908 **Pressure drop and heat transfer in viscoelastic duct flow - A new look.** Kostic, M.; Hartnett, J.P. (Energy Resources Center, Univ. of Illinois at Chicago, Chicago, IL (USA)). pp 1-8 of Fundamentals of convection in non-Newtonian fluids. Chen, J.L.S.; Ekmann, J.M.; Peterson, G.P. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870816—).

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Asymptotic friction factors and heat transfer j-factors for turbulent duct flow of viscoelastic fluids are viewed from a new reference - the extended laminar flow results which exhibit the lowest possible friction and heat transfer. This analysis suggests that the presence of elasticity laminarizes the flow. A simple model which takes account of the reinforced fluid structure resulting from the presence of macromolecular polymer chains is introduced to explain the decrease in the turbulence level associated with viscoelastic fluids. A major feature of the proposed model is that a viscoelastic fluid has a nonuniform and nonisotropic viscosity, which in a duct flow produced non-homogeneous turbulent fluctuations. The observed decrease in friction factor and heat transfer, as well as the large increases in critical Reynolds number and hydrodynamic and thermal entrance lengths are consistent with the model.

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REFER ALSO TO CITATION(S) 24393, 24424, 24436, 24675, 24867

24909 **(AEEW-R—2182) Impact studies at Winfrith.** Cooper, C.A.; Wicks, S.J. (UKAEA Atomic Energy Establishment, Winfrith). Feb 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752739/JAW.

Analytical and experimental studies of subsonic impacts on nuclear reactor plant structures have been in progress at Winfrith since 1977. These studies have examined the behaviour of concrete and metal structures under the impact of missiles typifying those derived either from the plant itself or from external sources, such as crashing aircraft. During 1986 the Winfrith programme was expanded to include studies of the behaviour of radioactive materials transport containers under impact conditions. This report initially describes the experimental facilities available for impact studies at Winfrith. These include both compressed air guns, capable of delivering payloads of up to 65 kg at sonic velocity or payloads up to 2 tonnes at speeds up to 45 ms/sup -1/, and drop test facilities for impact testing of models, up to full-scale radioactive materials transport flasks, at relatively low speeds. Supporting facilities include a small concrete manufacturing laboratory to produce concrete targets. Assessments of the resistance of concrete or metal structures to impact damage are performed using empirical or semi-empirical correlations, derived from data obtained in well-characterised experiments, or using structural dynamics finite element codes. The codes used by the analysts and the computing facilities available for impact analysis work are described. Finally the current programme of impact studies is reviewed, recent progress is summarised and future plans outlined.

24910 **(CEGB-TPRD/B—0722/R87) Model for assessing the errors in defect size measurement by ultrasonic probe movement techniques.** Langston, D.B. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752765/JAW.

The need to place upper bounds on the likely sizes of defects detected during ultrasonic inspection of nuclear plant components in order that a pessimistic assessment of their integrity can be carried out has recently focussed attention on the accuracy of the ultrasonic techniques used. The larger defects are sized by ultrasonic probe movement techniques in which the behaviour of the ultrasonic echo as a probe is scanned across the component is used to determine the positions of the opposite edges of a defect and hence its size. This report presents a basis on which the likely errors in defect size measurements made using such techniques can be assessed. The potential sources of error are identified, estimates of their magnitudes are presented and comparisons made, where possible, with examples of actual sizing errors based on destructive examinations of defects. The nature of each contributing error is examined in detail and the different methods, by which various types of error should be combined to arrive at an accurate assessment of the overall sizing error are described.

24911 **(CONF-870691—11) Ultrasonic beam distortion in transversely isotropic media.** Roberts, R.A.; Kupperman, D.S. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005937/JAW.

From Review of progress in quantitative NDE; Williamsburg, VA, USA (21 Jun 1987).

The distortion of beam profiles and skewing of beam energy observed in transmission of ultrasound into a transversely isotropic medium can lead to erroneous interpretations of NDE data for materials such as columnar-grain steels and fiber-reinforced composites. In this paper, results are presentd for the numerical evaluation of the exact Fourier integral representation of transmission of an arbitrary incident field from an isotropic into a transversely isotropic half-space. The problem is fully three-dimensional, i.e., the symme-

try axis of the transversely isotropic material is oriented arbitrarily relative to the half-space boundary and angles of incidence. The cases chosen for numerical study were selected from previously unexplained experimental data obtained from the study of propagation in columnar grain steels (welds), and from situations commonly encountered during the inspection of fiber-reinforced composites. Experimental results which give evidence to the numerically observed phenomena are presented. 11 refs., 4 figs.

24912 **(EGG-M—11087) Impact shock generator from explosively driven plates.** Korth, G.E.; Williamson, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 12p. (CONF-870753—80). NTIS, PC A03. Order Number DE88003596/JAW.

From 5. topical conference of the American Physical Society on shockwaves in condensed matter; Monterey, CA, USA (20 Jul 1987).

Experimental methods have been developed to produce well-defined impact stress waves from relatively large plates accelerated by commercially available explosives. Steel plates, 180 mm square and from 12.5 to 50 mm thick, are accelerated to velocities from 0.3 to over 1.0 km/s without spalling and produce relatively planar impacts. Numerical modeling was used as an aid in the experiment design and interpretation of results. Pin gages were used to measure velocity and planarity at impact. 5 refs., 6 figs.

24913 **(INIS-mf—11128) Crack detection '86.** (Ceska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky). 1986. 264p. (In German). (CONF-8611230—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW.

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

The participants of the conference heard 36 papers of which 13 were incorporated in INIS. The incorporated papers deal with the quality control of the equipment of nuclear power plants, with technical specifications and possibilities of diverse crack detection devices, as well as with personnel training for nondestructive materials testing. (E.S.).

24914 (INIS-mf—11128, pp 27-33) **Ultrasonic testing of nuclear reactor pressure vessel materials using SKODA REACTORTEST TRC automatic system.** Sladky, J. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

The SKODA REACTORTEST TRC automatic system is described used for ultrasonic testing of welded joints, overlays and areas under the overlays, as well as base material of nuclear reactor pressure vessels. Two types of probes are described used for inspection of welded joints and base materials and for overlays and areas under overlays. Also described is the determination of the sensitivity of the ultrasound part of the TRC. The specificities are discussed of ultrasound inspections of the pressure vessel of the WWER-440 reactor using the TRC (stainless steel overlay, echos). (E.S.).

24915 (INIS-mf—11128, pp 41-44) **Advances in industrial X-ray radiography.** Giese, R. 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

24916 (INIS-mf—11128, pp 45-50) **Experience from one year of operation of radiography equipment at CKD Kutna Hora.** Wisinger, R. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

24917 (INIS-mf—11128, pp 50-59) **Comparison of crack detecting and operating properties of X-ray TV chains from several manufacturers.** Forman, R.; Manas, V.; Gross, E.; Spika, L. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

The technical parameters are presented of the X-ray TV chain MU 15 F/160 by Philips, FRG; the X-ray TV chain TV1 by VPZ Praha-Bechovice, Czechoslovakia, the X-ray TV chain Baltscope 22 SPC by Balteau. Two pieces of weld joined steel sheets, two weld joined tubes of austenitic steel and a steel sheet were used as test samples. All samples were provided with bores of different sizes. In order to compare the said devices the samples were radiographed at different geometry and with the use of different size focuses. All results are tabulated. (E.S.). 3 figs., 3 refs.

24918 (INIS-mf—11128, pp 60-67) **X-ray image intensifier - design, properties and application.** Schmidt, P. 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

The design principle is described of an X-ray image intensifier which does not substantially differ from the first intensifier designed in the 1950's. Some improvements (replacement of a sedimented Zn-CdS layer with a layer of deposited CsI) and the subsequent processing of the output image have turned the intensifier into an instrument with a wide range of uses in nondestructive materials testing. The intensifier alone has an extremely broad dynamic range, i.e., range of light fluxes in which there is no flare or loss of resolution. Present intensifiers usually form part of a system in which the output image of the intensifier is recorded by a videocamera and transmitted to a monitor. In such a system the dynamic range is greatly reduced and obtaining sufficiently contrasting images requires meticulous optimization of conditions. The aim of the optimization is to attain such imaging by a TV chain which will preclude flare at possible openings reducing thickness to zero, and allow the thickest layer to be sufficiently light. Optimization procedures are described consisting in covering the openings, additional filtration and modification of brightness by changing voltage on the intensifier. The integration of several images, the use of electronic filters and fully automated evaluation may further increase the resolutin of the system. (A.K.). 7 figs.

24919 (INIS-mf—11128, pp 68-77) **Analysis of the potential of crack detection by neutron radiography.** Bizek, V.; Zavadil, Z. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

The principle is explained of nondestructive crack detection using neutrons. A survey is presented of sources, principles of moderation and collimation; the interaction is explained of neutrons with matter and methods of detection. The method of neutron radiography is used for inspecting fuel in nuclear power plants, for the detection of corrosion and water in aviation, crack detection of special alloys, in the chemical industry, engineering, testing of printed circuits in electronics, dosemeter calibration, etc. (M.D.). 2 figs, 1 tab.

24920 (INIS-mf—11128, pp 77-86) **Film-based industrial tomography.** Zavadil, Z. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

The method is undemanding on costs, relatively simple and uses equipment and means of conventional radiography. The common feature of all variants of transaxial tomography is the collection of intensity profiles of beams of ionizing radiation passed through the tested object following turning the object around the axis by regular angles. Explained are the principles of analog and computer processing of the results. The main advantage of film-

based industrial tomography is the accurate location of the defect in the section of the object. (M.D.). 6 figs., 3 refs.

24921 (INIS-mf—11128, pp 87-90) **Determination of exposure time for /sup 60/Co using pocket calculator SHARP PC-1211.** Svoboda, R. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

24922 (INIS-mf—11128, pp 90-93) **Radiographic inspection of filling of cavities with inserted reinforcement in reinforced concrete structures.** Hobst, L. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

24923 (INIS-mf—11128, pp 94-103) **Investigation of integrity of steel inserts and of homogeneity of filling of suspension of the first suspension bridge in Czechoslovakia.** Supcik, J. 1986. (In Czech). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

X-ray radiography inspection was made of samples of suspensions of the first suspension bridge in Czechoslovakia. The X-ray ANDREX system type CMA 30 was used for testing. The samples used had the following artificial detects: one sample had steel cable defects, the other had defects of filling. The location and shape of the defects are shown in figures. As for samples with artificial cable defects, the system showed all defects, as for samples with filling defects the device showed all but the so-called small defects. (E.S.). 7 figs., 1 ref.

24924 (INIS-mf—11128, pp 107-116) **Requirements on crack detection in pressurized vessels for ASME authorization.** Spremo, N.; Begovich, B.; Doko, A. 1986. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88701629/JAW. (CONF-8611230—).

From Crack detection; Karlovy Vary, Czechoslovakia (4 Nov 1986).

The method is presented of training qualified personnel for nondestructive testing of pressure vessels. Personnel is divided according to experience and previous training into three groups of which each has its own educational programme. Written examinations in general knowledge and in specialized subjects and a practical examination in crack detection terminate the training. (E.S.). 1 fig., 4 tabs., 3 refs.

24925 (SAND—88-0378C) **3-D solid rendering of NDT data.** Little, C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-880160—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006199/JAW.

From 30. meeting of the Weapons Agencies Nondestructive Testing Organization (WANTO); Largo, FL, USA (12 Jan 1988).

The Non-Destructive Testing division at Sandia Labs in Albuquerque is working on a solid rendering project to view volumetric data. Thresholding of the intensity levels within the volumetric data is used to determine the surfaces to be rendered. We are looking for a graphics system to display the surfaces with shading, lighting, rotation, translation, clipping, and hidden surface removal calculations performed in the graphics system. It should also allow the user to interactively modify the viewing position and lighting, and redraw the new view as quickly as possible, real time being ideal.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 24698, 24982, 24989, 25677

24926 (LBL—24490) **The influence of current stressing on the structure of Ag contacts to GaAs.** Liiental-Weber, Z.; Miret-Goutier, A.; Newman, N.; Jou, C.; Spicer, W.E.; Washburn, J.; Weber, E.R. (Lawrence Berkeley Lab., CA (USA); Stanford Univ., CA (USA). Stanford Electronics Labs.). Dec 1987. Contract AC03-76SF00098. 6p. (CONF-871273—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005988/JAW.

From Symposium on epitoxy of semiconductor layered structures; Boston, MA, USA (1 Dec 1987).

The stability of Ag Schottky contacts on GaAs after voltage and current stressing has been investigated. The barrier height and its stability against voltage and current stressing were found to depend on the diode fabrication method (metal deposition onto either air-exposed or ultra-high vacuum cleaved (uhv) substrates). The barrier height of Ag diodes formed on air-exposed surfaces is 0.96 eV, and a significant decrease of 70 MeV was found upon exposure to voltage and current stressing. In contrast, the barrier height of Ag diode formed on uhv cleaved samples is 0.89 eV, and no significant change was found upon exposure to stressing. The structure of the contacts was studied by transmission electron microscopy. Ag deposited on uhv cleaved substrates shows an epitaxial relationship to GaAs and atomically flat interfaces. Exposure to air before the metal deposition led to nonuniform reactions and compound formation at the interface as compared to uhv samples. After current stressing, void formation and electromigration of Ag were observed in the air-exposed contacts. Ag contacts formed on uhv-cleaved GaAs(110) were stable during current stressing. 7 refs., 5 figs.

24927 (NP—8770110) **Measurements and calculation of multiple reignitions when switching starting currents of motors.** Luxa, A. (Technische Univ. Berlin (Germany, F.R.). Fachbereich 19 - Elektrotechnik). 22 Dec 1986. 174p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770110/JAW.

The occurrence of multiple reignitions at switching starting currents of motors is not a special phenomenon of vacuum circuit breakers. However, multiple reignitions can generate overvoltages which have to be coordinated with isolation standards. The present thesis is concerned with summarizing necessary conditions of system and circuit breaker for the occurrence of multiple reignitions and accompanied effects pointing out the relevant factors. The shape of occuring voltages is investigated in relationship to other types of overvoltages. Different types of overvoltage protection-devices are investigated, and the occuring overvoltage level was measured. Finally, dimensioning criteria for motor simulation circuits in power plants are formulated according to a theoretical equivalence analysis and experimental studies. The new simulation model of vacuum circuit breakers allows a sufficiently correct estimation of all effects without real switching tests. (orig./HWJ).

24928 (SAND—87-2453) **Estimation of diode radiation photocurrent response from limited information.** Stuetzer, O.M. (L and M Technologies, Inc., Albuquerque, NM (USA)). Mar 1988. Contract AC04-76DP00789. 11p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006925/JAW.

Some basic parameters and the photocurrent response to a known x-ray pulse in a known test circuit are available for an SA1830 diode. From this and simple measurements, the missing parameters and the response to a differently shaped x-ray pulse in a different circuit are estimated. In the example given, the steady-state photocurrent and the response to a 20-ns triangular pulse have been predicted, given the response to a Febetron 705 flash x-ray pulse. 5 refs., 7 figs., 2 tabs.

24929 **(UCRL—97393) New applications and designs for deformable mirrors.** Bliss, E.S.; Smith, J.R.; Miller, R.L. (Lawrence Livermore National Lab., CA (USA); Kaiser Engineers (California) Corp., Oakland, CA (USA)). Dec 1987. Contract W-7405-ENG-48. 6p. (CONF-880110—21). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006576/JAW.

From SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering; Los Angeles, CA, USA (10 Jan 1988).

A rectangular deformable mirror is described which meets the low spatial frequency and low bandwidth requirements associated with thermal aberrations in a solid state zig-zag amplifier. We incorporate design features which simplify the design of the mirror itself and reduce the complexity of the associated control system. 4 refs., 7 figs.

24930 **Aging of Schottky diodes formed on air-exposed and atomically clean GaAs surfaces: An electrical study.** Miret, A.; Newman, N.; Weber, E.R.; Liliental-Weber, Z.; Washburn, J.; Spicer, W.E. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305 and Department of Materials Science, University of California, Berkeley, California 94720). *Journal of Applied Physics;* 63: No. 6, 2006-2010(15 Mar 1988).

In this report we show that the application of a large voltage and current stress can significantly change the barrier height of a given metal (Ag,Al,Au,Pd,Cr)/GaAs(110) contact. These changes of barrier height depend on the metal used, the method of fabrication of the diode (air exposed or UHV cleaved), and the intensity and direction of the potential and current during the electrical aging. In particular, the air-exposed Ag diodes exhibit the largest change in the barrier height (~85 meV) upon aging, while the UHV-cleaved Ag diodes do not exhibit a significant change. In the case of Au, both UHV-cleaved and air-exposed diodes show a small change (~20 meV). The barrier heights of Pd, Al, and Cr air-exposed diodes do not exhibit an appreciable change upon aging (i.e., <10 meV). The changes in barrier height are found to have a very consistent and characteristic logarithmic dependence upon time. Once the electrical aging is stopped, the barrier height is found to recover to near the unaged value. The long time constant of the aging process, the ability of the barrier height to recover after aging, the long time constant of the recovery process, and the acceleration of the recovery process by illumination suggest that the changes in the barrier height which occur upon electrical aging are due to the creation and/or annihilation of deep level traps near the interface. We also report a systematic study of a comparison of barrier height determinations for Ag, Al, Au, Cr, and Pd diodes formed on air-exposed and UHV-cleaved GaAs(110) surfaces.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 24280

24931 **(IMC/M—850106) Characterization of granulated blast furnace slag for Portland Cement replacement in concrete.** Hemmings, R.T.; Cornelius, B.J. (Industrial Materials Centre, Sheridan Park, Ontario (Canada). Materials Div.). 6 Jan 1985. 203p. (MICROLOG—86-05094). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A developmental blast furnace slag ground in the laboratory has been characterized as a potential replacement for concreting and mine backfill applications. The slags were characterized by a range of techniques including particle size analysis, specific gravity, chemical analysis, scanning electron microscopy-energy dispersive x-ray analysis, and x-ray powder diffractometry. It was found that the slag was highly vitreous and could be characterized as a calcium magnesium aluminosilicate glass with melilite as the minor crystalline component. The hydration of slag-cement pastes was investigated by following chemical composition of expressed pore fluids, calcium hydroxide and chemically bound water by thermal analysis, phase composition by XRD, and microstructural features. Thermal analysis indicates that calcium hydroxide is probably not formed to any significant extent by hydration of the slags. Phase and microstructural characterization of the slag-cement pastes indicates that portlandite, Ca(OH)/sub 2/, is present in lower concentration than the control. The pore structures of the slag-cement pastes were investigated by mercury intrusion porosimetry and their permablility to water at 500 psi.

24932 **(WC—8508) Evaluation of blast furnace slag from Algoma Steel Corporation's #7 blast furnace for possible use as an additive to concrete-sample preparation. Final report.** (Watts Cement Ltd., Sault Ste. Marie, Ontario (Canada)). Aug 1985. 66p. (MICROLOG—86-05090). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objectives where to prepare granulated slag samples from Algoma Steel's #7 blast furnace, prepare slag cement samples from the granulated slag, and obtain information regarding the grinding of granulated slag. Approximately 460 metric tons of granulated slag were produced. Granulated slag was ground into cement. Slag cement ground to 3400 and 4400 blaine had to be reground in a pilot scale mill to obtain a sample of 5800 blaine in fineness. All slag was distributed to laboratories for concrete testing and evaluation for possible use as a mine backfill binding agent.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 24106, 24570, 24586

24933 **(CANMET—8111) Combustion of Syncrude-coke in pyroflow pilot plant, June 1981.** Kuivalainen, R. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Nov 1981. 38p. (MICROLOG—83-4849). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Syncrude coke is a byproduct produced in large quantities by the syncrude oil sands extraction plant at Fort McMurray, Alberta, Canada. It has high specific energy content, being high in carbon content and low in ash but is considered a difficult fuel because it is low in volatiles and high in sulphur. Recirculating fluidized bed combustion is a potential method of burning this fuel and handling emission difficulties. The objectives were to find the optimum run conditions in which the best combustion efficiency and minimum pollutant emissions could be achieved. Limestone was used to control SO/sub 2/ emission and the effects of different imput variables to minimize limestone consumption were examined. The input variables selected were bed temperature, fuel feed rate (load), and ash recirculation. The important output variables were unburned material in flue gas and ash, SO/sub 2/ capture and NO/sub x/ emission.

24934 **(CANMET—IJ/82/3) Characterization and testing of Syncrude, Canstar, and Irish Cove limestones for use in Summerside FBC [fluidized bed combustors].** Johnson, I. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 22 Jul 1982. 18p. (MICROLOG—83-2876). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Three limestones have been tested for use in the control of SO/sub 2/ emission from fluidized bed combustors (FBC). All three limestones have acceptable shock calcination characteristics, that is, the amount of fine material generated when these limestones are injected into a hot FBC is expected to be small enough to not pose a problem. The extent of sulfation of these limestones was slightly lower than the average limestone used for the control of SO/sub 2/ emission from FBCs. There is not a significant difference between these three. Detailed descriptions of the test results and predictions are included.

24935 (DL—EPS/3PG10) Some unique management characteristics of residues from atmospheric fluidized-bed combustion. (Dillon (M.M.) Ltd., Ottawa, Ontario (Canada)). Jun 1987. 96p. (MICROLOG—87-05100). Environmental Protection Directorate, Environment Canada, 351 St. Joseph Blvd., Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Atmospheric fluidized bed combustion (AFBC) technology for solid fuels is under rapid development. One major impetus is the quest for reduced polluting emissions into the air during the combustion of low-quality coals. Other incentives include simplicity of design, construction, and operation as well as the potential to retrofit or repower existing installations at reasonable cost. Several different fluidized bed combustor designs are under development. The most widely tested on bench- and pilot-scale, and in demonstration units, is the bubbling bed design. The characteristics of the solid wastes from bubbling bed combustion are also under study to develop environmentally and economically optimal systems for waste collection, handling, transport, and disposal systems. Some waste characterization information may also be of benefit for refinement of the combustion technology itself. In this study, results of previous waste studies are re-evaluated on the basis of observations made at operating AFBC units. The laboratory results and field observations were then synthesized and used to develop outlines for practicable waste handling and disposal. 27 figs., 6 tabs.

24936 (EGG-M—26687) Research in industrial combustion systems: Current and future R and D. Rebello, W.J.; Keller, J.C. (EG and G Idaho, Inc., Idaho Falls (USA); PAR Enterprises, Inc., Fairfax, VA (USA)). 1987. Contract AC07-76ID01570. 9p. (CONF-8709166—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006789/JAW.

From 9. annual industrial energy technology conference; College Station, TX, USA (16 Sep 1987).

This paper briefly describes the current R and D activity in industrial combustion systems. The areas covered are novel burner systems, oxygen enriched systems, combustion controls and sensors and unique industrial process modifications. Some of the future research needs in industrial combustion systems have been identified. These include improved techniques of heat transfer to the load, improved sensors, plasmas to process materials and flash or pneumatic reactors for the metals, non-metals and petrochemical industries. 26 refs.

24937 (MC/C—CPL8316-3/4410) High temperature, high pressure gas stream cleanup: a review of the state of the art. Final report. (Monenco Consultants Ltd., Calgary, Alberta (Canada)). May 1987. 184p. (MICROLOG—87-05186). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report reviews the status of technologies for the removal of pollutants such as particulates, sulphur gases, hydrogen chloride and alkali metals from coal derived gases. The presence of these pollutants can cause corrosion and erosion in gas turbines when used in integrated gasification combined cycle power generation. The research results, expected performance, and cost information were used in an evaluation of the technologies. Cleanup systems used on commercial or near commercial gasifiers were reviewed. Texaco, Shell, Dow, BGC/Lurgi and KRW gasifiers were included. Only in the case of KRW was hot gas cleanup contemplated. Cleanup systems currently in use are low temperature, conventional systems similar to those used for natural gas sweetening. Research work in hot gas cleanup being carried out in Canada by federal and provincial government agencies, universities and industry was reviewed.

24938 (NP—8770080) Thermal characteristics of tunnel kiln cars, and their effects on the energy household of the combustion process. Hagens, H. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 19 Feb 1986. 211p. (In German). NTIS (US Sales Only), PC A10. Order Number DE88770080/JAW.

The tunnel kiln is the most common kiln in the ceramics industry, owing to its low energy consumption and to the mechanized transport of the charge by means of cars. To reduce the energy comsumption, the furnace design as well as the combustion process must be optimized. The tunnel kiln concept is investigated using a calculation model to obtain an optimized tunnel kiln car and calculate its energy conservation effect. The model was tested with several tunnel kilns. (HAG).

24939 (NP—8770091) Natural gas in the glass industry. Exchange of experience on economically efficient and non-polluting techniques for producing industrial glass. (Ruhrgas A.G., Essen (Germany, F.R.)). 1986. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Ths booklet contains the papers of an exchange of experience about the economic and ecological utilization of natural gas in the glass industry. This event took place in October 1985 and was organised by the Ferngas Nordbayern GmbH in conjuntion with Ruhrgas AG. The following problems were discussed: the energy demand of the glass industry development of an ash furnace development and optimation of natural gas burners, natural gas and environmental protection. Eight papers are dealt with in individual abstracts. (MOS).

24940 (NP—8770091, pp 65-76) Natural gas fuelling for glass melting furnaces. Sieger, W.; Schwarz, G. (Koerting A.G., Hannover, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient and non-polluting techniques for producing industrial glass.

Burners of gas melting furnaces is characterised by means of evaluation factors and suggestions for optimation are worked out. The importance of preheating of combustion air and the mixing intensity of natural gas and combustion air is discussed. Optimation of the flame shape of the natural gas burner of a pot furnace is one possibility to improve economic efficiency. The use of gas-jet burners is described with a view to flame engineering aspects. Some practical examples are given in order to compare the economic efficiency of oil- and gas burners. (HLN).

24941 (NP—8770091, pp 77-87) User's views on the pot furnace. Reber, A. (Nachtmann, F.X. Bleikristallwerke G.m.b.H., Riedlhuette, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient and non-polluting techniques for producing industrial glass.

Experiences and test results from practice are the basis for an assessment of the pot furnace. The burner, the recuperators, control of temperature and combustion air, furnace insulation and dust removal is discussed. Glass quality, changing of the pot and its service life, the possibility to melt pellets, refining and possible failure sources are also dealt with. Perspectives for the future and the assessment of the pot furnace are discussed. (HLN).

24942 A method for improving load turndown in fluidized bed combustors. Brown, R.C.; Foley, J.E. New York, NY; American Society of Mechanical Engineers (1987). 8p. (CONF-870816—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

Technical Paper 87-HT-42.

The authors are investigating a new concept in the design of fluidized bed combustors that improves load turndown capability. This design is based on control of heat transfer rate independent of combustion rate. The configuration under investigation consists of a central combustion bed surrounded by an annular fluidized bed that establishes overall heat transfer rate from the inner combustion bed. The two beds, physically divided by a wall, are fluidized independ-

ently by separate air plenums. Experiments were performed to evaluate the usefulness of this device in improving load turndown. For a given combustor firing rate and air-to-fuel ratio, a wide variation in combustion temperature could be achieved by controlling the flow of fluidization air to the annular fluidized bed. In other tests, a load turndown ratio of 8.7 was achieved while combustion temperature was held constant. Greater load turndown are expected as a result of the use of smaller particles and higher fluidization velocities in the annular bed.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 24613, 24646, 24648, 24652, 24687

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 24070, 24607

24943 (NP—8770091, pp 88-94) **Cutting environmental pollution with dust removal equipment for glass melting furnaces.** Bellersen, W. (Luehr, H. Staubtechnik G.m.b.H. und Co. K.G., Stadthagen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient and non-polluting techniques for producing industrial glass.

Dust removal from flue gas downstream of glass troughs must be tailor-made to fit the respective case and challenge. Selection criteria for suitable filter material are discussed. The influence of heat exchangers for crude gas cooling on the dust filters is described. Various arrangements of the filter elements and supporting baskets are mentioned. Various on-line and off-line filter cleaning methods are described. (HLN).

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 25319

24944 **(INIS-mf—11138) Annual research report 1982-1983.** (Manitoba Univ., Winnipeg (Canada). Cyclotron Lab.). 1983. 181p. NTIS (US Sales Only), PC A09/MF A01. Order Number TI88701939/JAW.

A major rebuilding of the University of Manitoba Spiral Ridge Cyclotron was initiated in 1982-83, beginning conversion to the push-push mode of operation. Research was carried on at other accelerator facilities. Highlights of the year include preparatory work for studies of tensor polarisation in dp breakup; improvements to the neutron beam facility and preliminary studies relevant to a future np radiative capture experiment; the completion of an important part of the (p,n) reaction program involving analogue states of mirror nuclei; studies of the mass-4 system; further studies of recoil polarisation effects in transfer reactions; and the identification of / sup 13/Cs as a unique tumor marker. During the year the Narodny Ion Accelerator was used as an ion implantation device in the study of Raman scattering from implanted materials.

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 25153

24945 **(CRN-VIV—35) Injector for the 35 MV tandem accelerator Vivitron of Strasbourg.** Haas, F.; Heng, G.; Hoffmann, J.; Muller, Ch.; Rebmeister, R. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Apr 1987. 12p. (CONF-870498—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752216/JAW.

From 7. tandem conference; Berlin, F.R. Germany (6 Apr 1987).

For the Vivitron, it is proposed to add a third channel to the present two channels MP-HVEC tandem injector. This new line consists mainly of the negative ion source, a preacceleration stage of 80 kV and a magnetic analysing dipole with a mass resolving power dm/m > 1/200. With this set up a satisfactory injection energy of 250 keV is reached.

24946 **(CRN-VIV—36) Present status of the construction of the Strasbourg 35 MV Vivitron tandem.** Letournel, M. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Apr 1987. 21p. (CONF-870498—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752214/JAW.

From 7. tandem conference; Berlin, F.R. Germany (6 Apr 1987).

The construction of the 35 MV Vivitron is in progress. At the end of 1986, the 50 m Long tank was already in situ in its new building located parallel to the existing MP building. Building and tank will be finished very soon in order to begin in June 1987, the construction of the generator inside the tank. Actually, the major part of the generator components have been ordered and will be delivered soon, i.e., post insulators, column insulators, discrete electrodes and column electrodes as well as the total gas handling system. Tests have been carried out, specially in 1986, on a complete real Vivitron section, on various post insulators and on the belt charging system in the CN machine. In addition, the subject of transients in the Vivitron in the event of spark with regard to the problem of the stored energy, its dissipation and the overvoltages, have been thoroughly investigated and discussed.

24947 **(CRN-VIV—37) Belt charging system for the 35 MV Vivitron accelerator.** Helleboid, J.M. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Apr 1987. 17p. (CONF-870498—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752215/JAW.

From 7. tandem conference; Berlin, F.R. Germany (6 Apr 1987).

A Van de Graaff belt charging system has been chosen for the Vivitron. Although classical in its principle and conservative in its design, it includes different new features that will be discussed in detail. The main electrical and mechanical characteristics are also reviewed together with the status of the project.

24948 **(HMI-B—443) Geodetic work on the heavy ion accelerator VICKSI.** Lazar, U.; Michaelsen, R.; Plechaty, L.; Willert, H. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik). Aug 1987. 72p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752240/JAW.

VICKSI, a heavy ion accelerator installation at the Hahn-Meitner-Institut Berlin, was improved by adding an 8 MV-Tandem-Van de Graaff as second injector for the cyclotron, which is used alternatively with the first injector, a 6 MV single-stage-Van de Graaff. Comprehensive survey work was necessary in order to fit the Tandem into the ion optical system. This report documents the work done and discusses some problems arising during this period. The appendix compiles the results for the new beam line as well as some results for the older parts of the VICKSI installation. (orig./HSI).

24949 **(LA-UR—87-3177) On designing a control system for a new generation of accelerators.** Schaller, S.C.; Schultz, D.E. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 6p. (CONF-8709151—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005826/JAW.

From Europhysics conference on control systems for experimental physics; Villars, Switzerland (28 Sep 1987).

A well-conceived plan of attack is essential to the task of designing a control system for a large accelerator. Several aspects of such a plan have been investigated during recent work at LAMPF on design strategies for an Advanced Hadron Facility control system. Aspects discussed in this paper include: identification of requirements, creation and enforcement of standards, interaction with users, consideration of commercial controls products, integration with existing control systems, planning for continual change, and establishment of design reviews. We emphasize the need for the controls group to acquire and integrate accelerator design information from the start of the design process. We suggest that a controls

design for a new generation of accelerators be done with a new generation of software tools. 12 refs.

4302 Beam Dynamics, Field Calculations, And Ion Optics

24950 Coupled-bunch instability in a circular accelerator and possible cures: Longitudinal-phase-space simulation. Stahl, S.; Bogacz, S.A. (Accelerator Theory Department, Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* 37: No. 5, 1300-1306(1 Mar 1988).

Coupled-bunch instabilities in a circular machine are effectively simulated using a longitudinal-phase-space tracking code (ESm-smcapsE). Two damping schemes based on intrabunch (Landau cavity) and bunch-to-bunch synchrotron tune spread are also examined. Some comparison of the tune spread induced via these schemes (as a measure of introduced Landau damping) is done in both cases. Finally, a simulation of active damping of the coupled-bunch instability through radial-position feedback is explored as another possible cure.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 25537

24951 (CRN-VIV—32) Propositions for the assembly of the electrostatic generator. Heugel, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Jan 1987. 18p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752190/JAW.

Assembly concerns the electrotatic generator, the reservoir, the stabilization and partially the control system. Propositions presented here concern only the assembly inside the reservoir. Two phases appear: one corresponding to the insulating structure (mecanicians are concerned), the second one to the typical parts of Van de Graaf where are concerned electronicians and electricians.

24952 (Juel-Spez—395) Development, fabrication and testing of uranium-based target elements for a spallation-neutron-source (SNQ). Pt. 1. Development and fabrication. Kirchhoefer, H.; Krautwasser, P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)). Mar 1987. 163p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88752026/JAW.

For the fabrication of uranium-based cladded target elements for high energy protons, the effect of casting on the stability of the γ-phase UMo10 alloy and the influence of bonding material (Ni, Al, Sn and Zn) and bonding layer thickness as well as the type of cladding (Zry2, AlMg3 and AlMgSi0.5) on the uranium-bonding-cladding interfaces were studied. In addition, bonding deposition methods (electrolytic coating and PVD) and joining techniques (hot isostatic pressing, extrusion, shrink fitting and soldering) were tested. Manufacturing procedures, material properties of the as-fabricated target pins as well as their behaviour under thermal cycling favour - in the absence of irradiation data - the following design recommendation: Spallation material; UMo10 (γ-phase), no bonding, cladding material: Zry2, cladding procedure: Hot isostatic pressing.

24953 Surface discharges for soft x-ray preionization in light-ion fusion accelerators. Woodworth, J.R.; Jaramillo, W.H. (Sandia National Labs., Laser Projects Div., Albuquerque, NM 87185). pp 81-82 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—). Contract AC04-76DP00789.

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

The authors are developing surface discharges as soft x-ray (XUV) sources to preionize anode surfaces in light-ion fusion accelerators. Their objective is the production of a lithium-ion beam on Sandia's Particle Beam Fusion Accelerator II (PBFA II). In previous experiments, XUV preionization at 60 kW/cm/sup 2/ and 10 mj/cm/sup 2/ on the anode surface has improved the turn-on time and peak ion power flow through the Applied-B ion diode on PBFA I and has directly produced a fluorine-ion beam from a LiF anode on Sandia's Nereus accelerator. In similar experiments others have used XUV illumination to generate a >90% pure sodium beam from a sodium-covered anode.

4304 Storage Rings

24954 (INIS-XN—5) Decree No. 85-456 of 23 April 1985 publishing the Agreement between the Government of the French Republic and the European Organization for Nuclear Research on the safety of facilities for the electron-positron collider (with three annexes), signed in Geneva on 31 October 1984. (International Atomic Energy Agency, Vienna (Austria)). 27 Apr 1985. 3p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780065/JAW.

Published in the Journal Officiel de la Republique Francaise of 27 April 1985.

CERN, whose headquarters are in Geneva, Switzerland, owns facilities extending onto French territory where its legal status is defined in an Agreement concluded with France. This new Agreement concerns the future electron-positron collider (LEP). Both parties consider that its operation on French territory should offer the same safety guarantees as provided by the French regime for major nuclear installations. To this effect, LEP facilities located on French territory will be subject to approval and control by the French authorities, represented by the Central Service for the Safety of Nuclear Installations. The provisions applying to French major nuclear installations will also be applied to LEP. (NEA)

24955 (MPI-PAE/Exp.El.—184) B-factory project at SIN. Lorenz, E. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Oct 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752042/JAW.

The motivation and essential parameters for a new e/sup +/ e/sup -/ storage ring optimized for banti b physics around 10 GeV center of mass energy are presented. The design aims for a luminosity of (0.8-4).10/sup 33/ cm/sup -2/ s/sup -1/. The price for the collider including injector and buildings has been estimated to be 125 MSFR. Some aspects of possible extensions of the storage ring and the detector requirements will be discussed.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 24955, 24978, 25118

24956 (CRN-HE—87-06) Analysis of Cherenkov rings measured with the final chambers of the Delphi Barrel-Rich. Bloch, D.; Dracos, M.; Dulinski, W. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752191/JAW.

In this paper, we present our analysis of Cherenkov rings measured with the Delphi Barrel - RICH final chambers; these chambers are designed, produced and tested by NIKHEF and CRN Strasbourg. We have therefore realized a test set-up which was put in operation at the CERN PS in a 10 GeV/cπ/sup -/ beam from July to December 1986.

24957 (GANIL-T—87-03) Architecture of an acquisition system-multiprocessors. Postec, H. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France); Caen Univ., 14 (France)). Jul 1987. 129p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752162/JAW.

To follow the huge increasing of concerned parameters in nuclear detection systems, acquisition systems become bigger and have to present very good rapidity performance. At Ganil, four de-

tection systems have been set in Nautilus reaction chamber, that lead to experiment configurations with 700 parameters to process. In front of present acquisition system limitation, a device more relevant to lecture of a large number of channels show off necessary. Functionalities already operating in other systems and hardware already used have been chosen; specific technical solutions were aldo developed to use the most recent techniques and to take in account the four detection system structure of the device.

24958 **(IPNO-DRE—87-29) S.O.F.I.: a scintillating optical fiber imager.** Leblanc, M.; Raymond, C.; Tricoire, H.; Valentin, L. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752197/JAW.

We present characteristics of a charged particle detector which combines optical fibers with a multianode photomultiplier. Our first prototype allows detection of /sup 32/P emitters on a 26 X 26 cm/sup 2/ surface with 1.5 mm and 5 mm resolutions, respectively for X and Y directions, and a 0.3 % efficiency. Improvements, presently under study, in both fiber qualities and photocathode efficiency should increase the device efficiency to 40 % and its resolution up to the optical fiber diameter (500 μm for the time being). Such characteristics would allow SOFI to replace autoradiographic films in biology and make it a convenient position sensitive detector in nuclear and particle physics.

24959 **(ISN—87-71) Fission product detection.** Liatard, E.; Akrouf, S.; Bruandet, J.F. (Grenoble-1 Univ., 38 (Francc). Inst. des Sciences Nucleaires). 1987. 10p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752189/JAW.

The response of photovoltaic cells to heavy ions and fission products have been tested on beam. Their main advantages are their extremely low price, their low sensitivity to energetic light ions with respect to fission products, and the possibility to cut and fit them together to any shape without dead zone. The time output signals of a charge sensitive preamplifier connected to these cells allows fast coincidences. A resolution of 12ns (F.W.H.M.) have been measured between two cells.

24960 (JAERI-M—86-080, pp 102-115) **Monoenergetic neutron fluence standards.** Michikawa, Taichi. (Electrotechnical Lab., Sakura, Ibaraki, Japan; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE86901587/JAW. (NEANDC(J)—120/U; INDC(JPN)—106/L; CONF-8511220—).

From Seminar on nuclear data; Tokai, Japan (12 Nov 1985).

Some topics on the standardization of monoenergetic fast neutron fluence are discussed taking account of the relationship between neutron fluence standards and nuclear standard data. Neutron fluence standards at energies of 144- and 565-keV, and that at nearly 14 MeV energy region are concentrated in this paper. At 144- and 565-keV, non-linear energy response of proton-recoil proportional counter is discussed based on the energy dependence of W-bar-value of recoil-protons in gas. Preliminary results of international intercomparison for 144- and 565-keV neutron fluence using /sup 115/In(n, γ)/sup 116m/In reaction are reviewed briefly. At 14 – 15 MeV of neutrons, the associated α-particle method is used as the primary standards for neutron fluence determination; the interference effect of /sup 3/He(d,p)/sup 4/He reaction following β-decay of tritium in the target to the associated α countings is discussed. Proton-recoil telescope also plays a role of primary standards of monoenergetic neutron fluence above – 2.5 MeV, and in this paper both non-parallel incidence effect of neutrons and multiple-scattering effect of recoil-protons in radiator are described for the determinations of absolute telescope efficiency by Monte Carlo method.

24961 **(JAERI-M—87-173) Double-energy double-velocity measurement system for fission fragments and its application.** Kanno, Ikuo. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 110p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752315/JAW.

A new system of double-energy double-velocity (DEDV) measurement for fission fragments has been developed. In this system, the energies of fission fragments are measured by silicon surface barrier detectors (SSB) and the velocities by the time-of-flight (TOF) method utilizing thin film detectors (TFD) as start detectors and SSBs as stop detectors of TOF. Theoretical and experimental studies on TFDs and SSBs have been performed before the construction of the DEDV measurement system. The TFD consists of a thin plastic scintillator film and light guide. The author proposes a new model of the luminescence production in a scintillator film. This model takes into account the thickness of the scintillator film and uses only one parameter. The calculated TFD response to charged particles shows good agreement with other experiments. The dependence of the TFD response to the thickness of the scintillator film has been studied experimentally and analyzed by the luminescence production model. The results of this analysis shows the validity of the luminescence production model. The time resolution of the DEDV measurement system using TFDs and SSBs was 133 ps. As an application of this system, the DEDV measurement for the thermal neutron-induced fission of /sup 233/U has been carried out at the super mirror neutron guide tube facility of Kyoto University Reactor (KUR). The energy and velocity of each fission fragment have been stored on magnetic disk event by event in a list mode. The analyzed results of masses, energies and velocities of light and heavy fragments agree well with other authors' works. The value of the total neutron emission number is 2.53 and shows good agreement within experimental error, with the JENDL-2 value, 2.49. The light fragment shows a slightly greater number of neutrons emitted than the other works. This suggests the possibility of larger deformation of light fragments at the scission point.

24962 **(KFK—4305) Neutron irradiations of proton-sensitive track etch detectors: Results of the joint European/USA/Canadian irradiations organized by EURADOS-CENDOS (1986).** Piesch, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Sep 1987. 74p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752024/JAW.

In 1986, the EURADOS-CENDOS group organized a joint neutron irradiation of proton-sensitive track etch detectors particularly CR-39 and CN-85. The purpose of this experiment was to investigate the energy response and the background track density of plastics under development for use as personnel neutron dosemeters. Dosemeters from 13 laboratories in the European Communities, the USA and Canada were sent to five laboratories and irradiated with monoenergetic neutrons of 144 keV, 250 keV, 570 keV, 1.2 MeV, 5.3 MeV, 14.7 MeV, and with Cf-252 neutrons, in the dose equivalent range between 1.5 mSv and 4.2 mSv. The report consists of short papers from each participant giving a description of the dosemeter used, the processing and evaluation method employed and a discussion of the measurement results.

24963 **(LA-UR—88-573) Fundamental noise processes in a laser excited optical filter.** Apel, E.C.; Gosnell, T.R.; Shay, T.M.; Samadani, R. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 7p. (CONF-871254—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006460/JAW.

From Lasers '87; Lake Tahoe, NV, USA (7 Dec 1987).

A rubidium narrow bandwidth optical filter is being investigated as a device for detecting weak narrow bandwidth radiation. In our configuration, the optical filter is actively pumped (or laser excited, i.e., LEOF). This configuration has a major inherent advantage over a passive optical filter, namely, wavelength versatility. One possible limitation to the Rb LEOF is due to an intrinsic noise source caused by the energy pooling of Rb 5p atoms which are produced by the pump laser. This process, i.e., Rb (5p) + Rb (5p) → Rb (5d) + [Rb(5s)] → Rb (6p), produces Rb atoms in the 6p state which subsequently emit radiation within the bandwidth of the detection channel (420-323 nm). Hence, this constitutes a noise process since photons are produced at the detector in the absence of narrow bandwidth "signal" radiation. Herein, we present preliminary results on kinetic studies of the energy pooling process with the ultimate goal of quantifying the process (rate constant determination) and thus assessing its implications. 4 refs., 3 figs.

24964 (LBL—22300, pp 30-33) **Initial results from the Donner 600-crystal positron tomograph.** Derenzo, S.E.; Huesman, R.H.; Cahoon, J.L.; Geyer, A.B.; Uber, D.C.; Vuletich, T.; Budinger, T.F. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Divisions: Annual report 1986.

These results show the 3-mm BGO crystals can improve the resolution in positron tomography by a substantial factor. This measured crystal-pair resolution of 2.4 mm FWHM and the reconstructed image resolution of 2.9 mm FWHM at the center of the tomograph are in good agreement with expected values. The most serious limitation of the detector design is that only a single section can be imaged. 4 refs., 4 figs.

24965 (MPI-PAE/Exp.El.—185) **Measurement of the light yield of common inorganic scintillators.** Holl, I.; Lorenz, E.; Mageras, G. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Oct 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752041/JAW.

The light yield in photons/MeV of some common inorganic scintillating crystals has been measured with silicon photodiodes. Incident particles are gammas in the 1 MeV region. The light signal was calibrated against 60 KeV gammas coverted directly in the photodiode depletion layer. Among the tested materials CsI(Tl) gave the highest light yield of 52 000 photons/MeV deposited energy.

24966 (NIKHEF-H—87-8) **High resolution hadron calorimetry. Invited talk.** Wigmans, R. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). 1987. 52p. (CONF-8703128—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88701773/JAW.

From International conference on advances in experimental methods for colliding beam physics; Stanford, CA, USA (9 Mar 1987).

The components that contribute to the signal of a hadron calorimeter and the factors that affect its performance are discussed, concentrating on two aspects; energy resolution and signal linearity. Both are decisively dependent on the relative response to the electromagnetic and the non-electromagnetic shower components, the e/h signal ratio, which should be equal to 1.0 for optimal performance. The factors that determine the value of this ratio are examined. The calorimeter performance is crucially determined by its response to the abundantly present soft neutrons in the shower. The presence of a considerable fraction of hydrogen atoms in the active medium is essential for achieving the best possible results. Firstly, this allows one to tune e/h to the desired value by choosing the appropriate sampling fraction. And secondly, the efficient neutron detection via recoil protons in the readout medium itself reduces considerably the effect of fluctuations in binding energy losses at the nuclear level, which dominate the intrinsic energy resolution. Signal equalization, or compensation (e/h = 1.0) does not seem to be a property unique to /sup 238/U, but can also be achieved with lead and probably even iron absorbers. 21 refs.; 19 figs.

24967 (RAL—87-081) **Improving the performance of plastic SQS tubes by means of a modified gas mixture.** Bateman, J.E.; Connolly, J.E. (Rutherford Appleton Lab., Chilton (UK)). 1987. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752789/JAW.

In the course of developing the plastic SQS detector modules for the muon endcaps on the OPAL experiment, we met with great difficulty in achieving reliable operation from the devices when following the accepted design and operation methods. Study of the breakdown modes of the devices revealed that interaction with the cathode surfaces seemed to be a key factor. In an attempt to ameliorate the situation the standard gas mixture was modified to include a very small doping of a liquid freon. With this gas stable operation became routine with counting plateaux of just on 90% over a range of 400 V in EHT. The pulse height spectra obtained with the doped gas give some insight into the streamer mechanism.

24968 (RAL—87-094) **Performance of a prototype drift chamber with 100 MHz FADC readout.** Tkaczyk, S.M.; Blissett, J.A.; Hart, J.C. and others. (Rutherford Appleton Lab., Chilton (UK)). Nov 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752790/JAW.

Rectangular drift chamber cells have been constructed and tested using an electron test beam facility at DESY. A systematic study of the time, space, energy and double track resolution with a 100 MHz FADC readout is presented. The spatial resolution is 100 μm to 120 μm and the double track resolution is 2.5 mm with an Ar:C/sub 2/H/sub 6/ (50:50) gas mixture at atmospheric pressure. The dE/dx resolution obtained corresponds to 6% resolution for a 72-layer chamber.

24969 (SLAC-PUB—4488) **The response of survey meters to pulsed radiation fields.** McCall, R.C.; Ipe, N.E. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1987. Contract AC03-76SF00515. 4p. (CONF-880404—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88004390/JAW.

From 7. international congress of the International Radiation Protection Association; Sydney, Australia (10 Apr 1988).

The response of most survey meters to steady radiation fields is fairly well known and documented. However, hardly any data is available in the literature regarding the response of these instruments to pulsed radiation. Pulsed radiation fields are encountered, e.g., in the vicinity of linear electron accelerators or klystrons. An instrument that ordinarily responds well to the average dose rate spread out evenly in time may not be able to cope with such a high dose rate. Instruments which have long dead times such as Geiger Mueller and proportional counters tend to become saturated in such fields and only count repetition rate. Ionization chambers are less influenced, however, they must be operated with adequate voltage to overcome recombination losses. Scintillation survey meters may become non-linear at higher dose rates for pulsed radiation because the photomultiplier cannot handle the instantaneous currents that are required. Because of the need to test the response of different radiation detection instruments to pulsed fields, a pulsed x-ray facility has been built (I/sub p/87). A brief description of this facility is given along with tests of several different instruments. 5 refs., 4 figs., 1 tab.

24970 (SSI—87-07) **Alarm criteria for the fixed gamma radiation monitoring stations.** Kjelle, P.E. (National Inst. of Radiation Protection, Stockholm (Sweden)). 2 Mar 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752721/JAW.

Translated from Swedish: Larmkriterier foer SSI: S fasta maetstationer (SSR--87-04).

For the type of measurement considered here, an alarm based on the dose excess has been shown to be a more certain method of indicating that a true alarm situation exists than an alarm based on the dose-rate exceeding a given dose-rate level. The method offers a number of advantages: Dose-rate levels can be recorded over long periods without any necessity of making manual changes in the alarm level due to seasonal variations in the background level. A relatively low level can be specified without an unnecessary number of false alarms being triggered by gamma-emitting radon daughters.

24971 (UCRL—96342) **Is CR39 worth the effort?.** Griffith, R.V. (Lawrence Livermore National Lab., CA (USA)). 2 Dec 1987. Contract W-7405-ENG-48. 5p. (CONF-880404—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88004353/JAW.

From 7. international congress of the International Radiation Protection Association; Sydney, Australia (10 Apr 1988).

CR39 proton sensitive track detectors were greeted by the radiation protection community at the end of the last decade as a major breakthrough for personnel neutron dosimetry. A number of laboratories eagerly began research on application of CR39 to their dosimetry needs. However, in the last two or three years the enthusiasm has subsided, and many health physicists have stopped working with the material. The number of participants using CR39 in the Oak Ridge National Laboratory Personnel Intercomparison Studies dropped from six in 1985 to three in 1986. On a national

level, the Federal Republic of Germany with researchers active in CR39 research recently adopted an albedo system as their national standard. In contrast, the United States Department of Energy (DOE) is supporting development of a CR39 based combination dosimeter to meet Department wide dosimetry needs. The English National Radiological Protection Board (NRPB) now features the use of CR39 in the NRPB PADC(CR39). There has obviously been a range of experiences with CR39 in the dosimetry community. Why has this been the case, and what is the proper role for CR39 in personnel neutron dosimetry. 12 refs., 2 figs., 1 tab.

24972 **Level 3 system at CDF.** Carroll, J.T.; Larwill, M.; Beretvas, A.; Devlin, T.; Flaugher, B.; Joshi, U.; Miyashita, S.; Morita, Y. (Fermi National Accelerator Lab., Batavia, IL (USA); Rutgers - the State Univ., Piscataway, NJ (USA); Tsukuba Univ., Sakura, Ibaraki (Japan)). *Nuclear Instruments and Methods in Physics Research;* **263**: No. 1, 199-205(1 Jan 1988). (CONF-8606240—).

From 3. Pisa meeting on advanced detectors; Pescaia, Italy (2 Jun 1986).

Level 3 uses 32-bit microprocessors installed in VME crates to execute FORTRAN filter algorithms. The system is integrated into the CDF FASTBUS data acquisition network which is designed to support event rates of 100 Hz into Level 3. Filter algorithms access event data in the same detector bank format as used for off-line analysis.

24973 **Polycarbonates and copolycarbonates as dosemeters.** Huang, S.J.; Davis, C.R.; Yang, C.S.; LeBarron, L.; Feldman, J.; Johnson, J.F.; Hadlock, D.E.; Parkhurst, M.A. (Connecticut Univ., Storrs, USA. Inst. of Materials Science; Battelle Pacific Northwest Lab., Richland, WA, USA). *Radiation Protection Dosimetry;* **20**: No. 1-2, 37-39(1987). (CONF-870525—). Contract AC06-76RL01830.

From Workshop on development of personnel neutron dosimeters based on track etch detectors; Harwell, UK (12 May 1987).

The obstacle of inconsistent properties of CR-39 polycarbonate as etched track dosemeters has been overcome with the multistage thermal polymerisation of purified monomer. Excellent linear correlation of track density with neutron dosage was observed after chemical and/or electrochemical etching. Excellent tracks were also obtained for radon exposure. Copolymers of CR-39 with methyl acrylamido glycolate methyl ether, MAGME, have been explored as a means of improving track etching and better simulating human tissue.

24974 **Preliminary study on the use of the track size distribution on electrochemically etched CR-39 foils to infer neutron spectra.** Hankins, D.E.; Westermark, J. (Lawrence Livermore National Lab., CA, USA). *Radiation Protection Dosimetry;* **20**: No. 1-2, 109-112(1987). (CONF-870525—).

From Workshop on development of personnel neutron dosimeters based on track etch detectors; Harwell, UK (12 May 1987).

We are studying the relationship between neutron energy and track size distribution on electrochemically etched CR-39 foils using a two-stage etching procedure. Although the electrochemical etching process alters the track size, we now find that the track diameter is related to the neutron energy even after the second stage (blow-up) is completed. This relationship is complex, being affected by the etching parameters, including oven temperature, etching high voltage, and etching time. Current studies are directed at establishing the effect of each of these parameters on the track size distribution and at determining an optimal etching procedure for neutron spectra evaluation.

24975 **US progress on the development of neutron dosemeters based on CR-39.** Hadlock, D.E. (Pacific Northwest Lab., Richland, WA, USA). *Radiation Protection Dosimetry;* **20**: No. 1-2, 117-119(1987). (CONF-870525—). Contract AC06-76RL01830.

From Workshop on development of personnel neutron dosimeters based on track etch detectors; Harwell, UK (12 May 1987).

Historically at US nuclear facilities, two types of personnel neutron dosemeters have been in routine use: nuclear track emulsion Type A (NTA) film and thermoluminescence dosemeters (TLD) albedo. Both of these dosemeters have energy dependent responses. The neutron energy spectra must therefore be known to interpret the dosemeter results properly. As a result, a new state-of-the-art dosimetry system has been developed within the US Department of Energy (US DOE); Personnel Neutron Dosemeter Evaluation and Upgrade Programme. This system is the combination thermoluminescence dosemeter/etched track dosemeter (TLD/TED). This paper presents US DOE research presently being conducted to enhance further the TED portion of the combination TLD/TED system. The research areas involved include: dose sensitivity, neutron energy range, specialised radiators, self-developing dosemeters, and neutron spectrometry.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 24554, 24653, 24701, 24870, 24906, 24918

24976 **(BNL—40759) An x-ray microprobe beam line for trace element analysis.** Gordon, B.M.; Hanson, A.L.; Jones, K.W.; Kwiatek, W.M.; Long, G.J.; Pounds, J.G.; Schidlovsky, G.; Spanne, P.; Rivers, M.L.; Sutton, S.R. (Brookhaven National Lab., Upton, NY (USA); Chicago Univ., IL (USA)). 1987. Contract AC02-76CH00016. 5p. (CONF-8708180—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006358/JAW.

From Symposium on X-ray microscopy; Upton, NY, USA (31 Aug 1987).

The application of synchrotron radiation to an x-ray microprobe for trace element analysis is a complementary and natural extension of existing microprobe techniques using electrons, protons, and heavier ions as excitation sources for x-ray fluorescence. The ability to focus charged particles leads to electron microprobes with spatial resolutions in the sub-micrometer range and down to 100 ppM detection limits and proton microprobes with micrometer resolution and ppM detection limits. The characteristics of synchrotron radiation that prove useful for microprobe analysis include a broad and continuous energy spectrum, a relatively small amount of radiation damage compared to that deposited by charged particles, a highly polarized source which reduces background scattered radiation in an appropriate counting geometry, and a small vertical divergence angle of ~0.2 mrad which allows for focussing of the light beam into a small spot with high flux. The features of a dedicated x-ray microprobe beam line developed at the National Synchrotron Light Source (NSLS) are described. 4 refs., 3 figs.

24977 **(BNL—40760) X-ray fluorescence imaging with synchrotron radiation.** Rivers, M.L. (Chicago Univ., IL (USA). Dept. of Geophysical Sciences). 1987. Contract AC02-76CH00016. 8p. (CONF-8708180—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006299/JAW.

From Symposium on X-ray microscopy; Upton, NY, USA (31 Aug 1987).

The micro-distribution of trace elements is of great interest in fields such as geochemistry, biology and material science. The synchrotron x-ray fluorescence microprobe provides a technique to quantitatively measure trace element compositions at individual points and to construct semiquantitative two dimensional maps of trace element compositions. This paper describes an x-ray fluorescence system used at the National Synchrotron Light Source.

24978 **(BNL—40762) Advances in geochemistry and cosmochemistry: Trace element microdistributions with the synchrotron x-ray fluorescence microprobe.** Sutton, S.R.; Rivers, M.L.; Smith, J.V.; Jones, K.W. (Chicago Univ., IL (USA). Dept. of Geophysical Sciences; Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 6p. (CONF-8708180—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006355/JAW.

From Symposium on X-ray microscopy; Upton, NY, USA (31 Aug 1987).

Synchrotron radiation induced x-ray fluorescence analysis offers several advantages for chemical analyses of geological specimens over conventional geochemical techniques, such as electron microprobe and neutron activation analysis. Most important, high spatial resolution coupled with high elemental sensitivity allows analyses of trace elements on individual crystals, as opposed to bulk

rocks or mineral separates, and the essential ability to avoid commonly occurring inclusions within these grains. The capability for detailed trace element mapping of geological specimens opens up new areas of studies. For example, laboratory studies of geochemical behavior can be performed under pressure, temperature and geochemical conditions which approximate geological environments more closely than ever before. The non-destructive nature of the analysis leaves specimens available for study by complementary techniques. The present microprobe uses continuum radiation from an arc magnet as the excitation source and an energy dispersive detector (30 mm^2 Si(Li)). With this apparatus, minimum detection limits are typically several ppM for 20 micrometer spots. The purpose of this paper is to summarize the initial results of geochemistry and cosmochemistry experiments performed on this instrument through collaborations between BNL staff scientists and geoscientists from universities and industry. 13 refs.

24979 **(DP-MS—88-2) Application for R and D 100 award: The UNWRAP SYSTEM.** Mosley, W.C. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006502/JAW.

This paper describes a system developed to inspect the inner surfaces of tubes to verify that they are ready for welding. Color video images are taken of a tube's bore. The image displayed is "unwrapped" so that it appears just as if the tube had been cut along one side and lain flat. Some data and a picture are included. 4 figs., 1 tab. (JDH)

24980 **(EML—496) A user's guide to SWIFT: A Monte Carlo technique for inference of differential energy spectra from multisphere spectrometer measurements.** Sanna, R.S.; O'Brien, K. (Department of Energy, New York (USA). Environmental Measurements Lab.). Dec 1987. 25p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006686/JAW.

SWIFT is a FORTRAN-77 program written for the VAX-11/750 computer. Its purpose is to unfold neutron spectra from multisphere spectrometer measurements using the Monte Carlo technique. This guide describes the code in sufficient detail to enable a user, with a background in FORTRAN programming, to alter the code for use with other spectrometers and/or to install it on computers other than the VAX-11/750. The code and the required input and resulting output are described. As an aid to its implementation, input and output for a sample problem are also presented. 19 refs., 1 fig., 6 tabs.

24981 **(FRNC-TH—3073) Development of a human body RMN imaging device.** Saint-Jalmes, H. (Paris-11 Univ., 91 - Orsay (France)). Mar 1984. 137p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752160/JAW.

Imaging device for human body is studied in this thesis. The section images presented are got by a projection-reconstruction method associated to a section plane selection by an oscillating gradient application. Different stages of the machine development are presented: - design and calculation of a resistive magnet for very homogeneous field imaging - design of gradient coils for imaging magnets - realization of control and acquisition interfaces - realization of imaging software in real time.

24982* **(UCRL—21017) Summary and conclusions on electrooptical streak camera project.** Welch, B. (Arizona State Univ., Tempe (USA)). [1988]. Contract W-7405-ENG-48. 28p. NTIS, PC A03. Order Number DE88006616/JAW.

Two modifications to the evaluation set-up which would provide increased insight into the performance of the crystal streaking camera were proposed. The first of these has been tested with the results included in this report. The simple RC ramp circuit was modified by placing a diode across the output capacitance which shorts out the over-shoot which could depolarize the crystal. A pulser was added between the Stanford Research logic pulse generator and the Bragg cell modulator. This pulser is gated on and off to produce several laser pulses during the ramp. The concept was to be able to observe directly the resolvability of individual laser pulses beginning with 1 pulse on then two pulses on during the ramp, then increasing the number of pulses until the individual pulses are no longer resolvable. This can be converted into CTF (contrast transfer function) plotted against LPM (line pairs per millimeter) used in the evaluation of streaking cameras. The second modification proposed is to place the crystal in a liquid environment which will enable the application of voltages between 10 and 20 kV across the 1.3 mm crystal. A suitable liquid has been identified and ordered, Fluorinert, manufactured by 3M, with a breakdown strength of about 21 kV per 1.3 mm. This should enable a deflection of about 250 pixels (at 16.25 kilo-volts) with the present optics or 500 pixels with a mirror causing two passes through the crystal.

24983 **(UCRL—97654) Heterodyne phase shift diagnostic for measuring atomic vapor density.** Crane, J.K.; Paisner, J.A.; Johnson, M.A.; Story, T.W.; Barclay, C.; George, J.D.; Wyeth, R.W.; Christensen, J.J. (Lawrence Livermore National Lab., CA (USA)). 12 Nov 1987. Contract W-7405-ENG-48. 7p. (CONF-880402—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003955/JAW.

From CLEO '88: OSA/IEEE conference on lasers and electro-optics; Anaheim, CA, USA (25 Apr 1988).

We describe a technique for atomic density measurements. We generate and recombine frequency shifted laser beams producing beat signals on reference and signal detectors. Opacity in the signal detector leg is proportional to the phase difference between detector signals. 4 refs., 2 figs.

24984 **(UCRL—97659) Laser-heterodyne interferometry with streak camera detection.** Feldman, M.; Salmon, J.T.; Mockler, D. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 8p. (CONF-880402—6). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003292/JAW.

From CLEO '88: OSA/IEEE conference on lasers and electro-optics; Anaheim, CA, USA (25 Apr 1988).

The spatial interference pattern between a cw laser local oscillator and a pulsed laser (40 to 80 ns pulsewidth) is recorded by an electronic streak camera. Analysis yields time dependent wavefront and frequency chirp characteristics of single laser pulses. 2 refs., 3 figs.

24985 **Improved deep level transient spectroscopy method.** Hjalmarson, H.P.; Samara, G.A.; Farmer, J.W. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **63**: No. 5, 1801-1804(1 Mar 1988). Contract AC04-76DP00789.

An examination of the DLTS (deep level transient spectroscopy) technique suggests a new method for analyzing data for DLTS signal intensity S(T) as a function of temperature T. It is shown that the low-temperature asymptotic slope of a plot of ln S(T) vs 1/T yields the activation energy for deep level emission rates. Thus, in the new method, deep level energies are obtained from one run at a given rate window in contrast with traditional DLTS for which several runs at various rate windows are needed to obtain the same information.

45 EXPLOSIONS AND EXPLOSIVES

24986 **Application of front tracking to two-dimensional curved detonation fronts.** Bukiet, B. (MS-B214 Los Alamos National Lab., Los Alamos, NM 87544). *SIAM Journal on Scientific and Statistical Computing;* **9**: No. 1, 80-99(Jan 1988). Contract AC02-76ER03077.

This is the first of a series of papers describing a program which has a potential for achieving a significant improvement in the numerical modeling of detonation waves. In this paper, the authors establish the convergence of the front tracking method for two-dimensional detonation problems. The Chapman-Jouguet (CJ) thin flame model is used. An iterative method for the solution to these model equations, and for which they prove convergence, is described. They then take as a test problem a cylindrically symmetric expanding strong detonation wave. The solution to the model equations in this geometry by the random choice method with operator splitting computed on a fine grid is taken to be exact. The

convergence of the front tracking solution to this solution is discussed and convergence rates are established. The methods described above use planar detonation wave speeds. Corrections due to curvature are needed especially for unsupported diverging detonations.

4501 Chemical

REFER ALSO TO CITATION(S) 24079

24987 **(OU/CE—8208) Modelling of ignition and buildup to detonation in slurry explosives. Phase 3.** Lu, B.C.-Y.; Chung, W.K.; Yu, J.M. (Ottawa Univ., Ontario (Canada). Dept. of Chemical Engineering). Aug 1982. 177p. (MICROLOG—83-2122). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The study of Phases 1 and 2 on the formation and distribution of hot spots in slurry explosives under projectile impact was extended. The properties of projectile were incorporated in the calculation in this work. The explosive component of the hypothetical slurry explosive considered in most cases was liquid nitromethane. In the calculation, the Arrhenius burning rate was used for nitromethane instead of the Forest Fire Model because of the lack of necessary experimental data for determining the co-efficients of the model. The volume percentage of air in the slurry explosive was varied from 15.0 to 30.0. The projectile velocity considered was in the range of 200 to 600 m/sec. In the study, the effects of inert solid to liquid ratio, the dimension of the explosive container, and the presence of a solid explosive, in addition to nitromethane, were also investigated. A total of 44 cases have been studied in this work. 35 figs., 4 tabs.

24988 **(SAND—88-0266C) Aging and compatibility studies for the WW42C1 primer.** Massis, T.M.; Durand, N.A.; Weinmaster, R.R.; Johnson, R.L. (Sandia National Labs., Albuquerque, NM (USA); Unidynamics, Phoenix, AZ (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880473—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006497/JAW.

From American Defense Preparedness Association Compatibility symposium; New Orleans, LA, USA (18 Apr 1988).

A two year aging and compatibility study was conducted with the WW42C1 primer at 70°C in the presence of hydrogen and helium. Except for a 50% thermal decomposition of the tetracene in the priming composition, no other aging, stability, or compatibility problems were found. Functional performance also did not change over the two year aging period. 9 refs., 2 figs., 5 tabs.

4502 Nuclear

REFER ALSO TO CITATION(S) 24609

24989 **(AD-A—187535/0/XAB) Dynamic analysis of the parallel-plate EMP (Electromagnetic Pulse) simulator using a wire-mesh approximation and the numerical electromagnetics code. Final report.** Gedney, S.D. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Sep 1987. 166p. (CERL-TECHNICAL-MS-M—87/15). NTIS, PC A08/MF A01.

The electromagnetic pulse (EMP) produced by a high-altitude nuclear blast presents a severe threat to electronic systems due to its extreme characteristics. To test the vulnerability of large systems, such as airplanes, missiles, or satellites, they must be subjected to a simulated EMP environment. One type of simulator that has been used to approximate the EMP environment is the Large Parallel-Plate Bounded-Wave Simulator. It is a guided-wave simulator which has properties of a transmission line and supports a single TEM model at sufficiently low frequencies. This type of simulator consists of finite-width parallel-plate waveguides, which are excited by a wave launcher and terminated by a wave receptor. This study addresses the field distribution within a finite-width parallel-plate waveguide that is matched to a conical tapered waveguide at either end. Characteristics of a parallel-plate bounded-wave EMP simulator were developed using scattering theory, thin-wire mesh approximation of the conducting surfaces, and the Numerical Electronics Code (NEC). Background is provided for readers to use the NEC as a tool in solving thin-wire scattering problems.

24990 **(LA—11238-MS) Constellation sizing for modest directed energy platforms.** Canavan, G.H.; Hammond, J.H. (Los Alamos National Lab., NM (USA)). Apr 1988. Contract W-7405-ENG-36. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007033/JAW.

Discussions of boost phase directed energy constellation scaling have concentrated on tradeoffs for large lasers and mirrors, which require development. This report explores more modest lasers that could be deployed sooner, finding that for anticipated threats, performance and effectiveness are adequate.

4503 Explosion Detection

24991 **(AD-A—187530/1/XAB) Teleseismic observations from OSS IV.** Butler, R.; Duennebier, F.K. (Hawaii Univ., Honolulu (USA). Hawaii Inst. of Geophysics). 1987. 7p. (HIG-Contrib—1669). NTIS, PC A02/MF A01.

Pub. in Initial Reports of the Deep Sea Drilling Project, Vol. 88, 147-153(1987).

One of the primary objectives in placing seismic systems in deep-ocean boreholes is the detection of teleseismic earthquakes and nuclear events. If the oceanic basement is substantially quieter than the ocean floor and island sites, then the added data could yield information of considerable value in nuclear-test detection. This chapter presents and evaluates data relevant to this problem. The smallest teleseismic (Delta $> 30°$) earthquake observed on the ocean sub-bottom seismometer (OSS) had a body-wave magnitude of 5.4. Only one nuclear explosion (m/sub b/ = 5.6) was clearly observed. With additional filtering and processing, nuclear explosions as small as m/sub b/ = 5.1 can be marginally observed. OSS records many regional earthquakes of the northwest circum-Pacific area that are not listed in the National Earthquake Information Service catalog. Teleseismic P-wave arrivals for several events contain frequencies as high as 8 Hz above the background noise. No teleseismic short-period S waves were seen, although high-frequency S waves from regional events were abundant. This dichotomy in the observability of S waves by OSS suggests that the lithosphere of the northwest Pacific has a high Q, but that the underlying asthenosphere is more highly attenuative.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

24992 **(IC—86/239) Present status of artificial rain making.** Choudhury, A.M. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701823/JAW.

In this paper a review has been made of the present status of artificial rainmaking. The history of artificial rainmaking goes back to 1946 when Vincent Schaefer of the USA discovered the general principles. During the last 40 years cloud seeding activities have stirred the imagination of scientists all over the world. If this could be carried out in an operational manner, mankind could have solved the problems of drought which threaten many parts of the globe with famine. However, though a lot of progress has been made in cloud physics, an operational rainmaking programme is yet far from reality. In some cases seeding increases the rainfall whereas in other cases a decrease in rainfall has been noticed. It would be necessary to approach the subject more thoroughly and systematically and while making experiments on rainmaking a proper experimental design should be carried out so that the results of such experiments could be evaluated scientifically. (author). 11 refs.

24993 **(IC—86/240) Our climate in danger.** Choudhury, A.M. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1987. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701824/JAW.

In this paper, the effect of the increase in the temperature of the earth's atmosphere as a consequence of the increase in the CO/

sub 2/ content and other trace gases has been reviewed. The results have been obtained by a number of model studies. The effect of the depletion of the ozone layer has also been considered. There is the horrific prediction that the global mean temperature of the earth will rise by about 3 deg. C and the antarctic ice will melt by the middle of the next century. As a result, the mean sea level will rise by several meters and this will make many cities and countries or part of countries vanish from the globe. As Bangladesh is a low deltaic region, it will be specially vulnerable. Model computations show that in some regions rainfall will increase whereas in other regions specially in the tropics, rainfall will decrease and desertification will increase. If this happens, mankind will be faced with a major disaster in history. Effect on the society in general and remedial measures have been discussed. (author). 14 refs, 3 figs, 6 tabs.

24994 **(IC—86/321) Polytropic degeneracy.** Abdel Wahab, M.M. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701831/JAW.

The governing equations of free atmosphere were adapted to represent a polytropic flow. The conservation property in a rotating flow was found to be (C Δ T/2w + 2w)/rho which is independent on the velocity field of the flow. This quantity corresponds to potential vorticity in the actual atmospheric flow. (author). 1 ref.

5001 Basic Studies

REFER ALSO TO CITATION(S) 24204, 25015, 25033

24995 **(CONF-8309410—1) The synoptic climatology of winter surface temperature in the United States in relation to the monthly mean 700 mb circulation.** Klein, W.H.; Kline, J.M. (Maryland Univ., College Park (USA). Dept. of Meteorology). 1983. Contract AS05-81EV10539. 9p. NTIS, PC A02. Order Number DE88005333/JAW.

From 2. international meeting on statistical climatology; Lisbon, Portugal (26 Sep 1983).

The relationship between surface temperature and 700 mb heights has been the subject of considerable study. Correlation fields between 5-day mean anomalies of surface temperature and 700 mb height 2 days earlier during the winter season were constructed for 30 stations across the United States by Klein et al. (1959). Similar fields for simultaneous anomalies of 5-day mean temperature and height were published by Klein (1965) for a network of 15 cities. The object of the present paper is to increase our knowledge of synoptic climatology by extending the work described above from 5-day mean to monthly mean data, and to do so for a longer time period, larger number of stations, finer grid of heights, and larger area. By analyzing and summarizing numerous correlation fields and height anomaly maps, regional differences in the relations between temperature and circulation will be highlighted, and schematic models of 700 mb height for opposite extremes of surface temperature will be constructed.

24996 (PNL—6100-Pt.3, pp 9-10) **Solar radiation fields in areas of complicated terrain.** Allwine, K.J.; Whiteman, C.D. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

Example results are presented from a FORTRAN program, SOLAR, that was constructed from equations derived by previous investigators to calculate extra-terrestrial solar flux. This program can be used to calculate extraterrestrial solar flux on planes of arbitrary inclination and azimuth angle at any point on the Earth's surface; thus, fields of solar flux can be calculated in areas of complicated terrain. The extra-terrestrial solar flux calculations specify the flux at the edge of the Earth's atmosphere.

24997 (PNL—6100-Pt.3, pp 13-15) **PNL studies of the turbulence structure of nocturnal slope flow.** Horst, T.W.; Doran, J.C. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

Turbulence data were collected at the Rattlesnake Mountain slope wind site during the summer and fall of 1983, and the structure of turbulence in slope flow was compared to that found over flat terrain. The authors used the turbulence covariance model of Brost and Wyngaard to predict local turbulence scaling for slope flow. The model results for slope flow have been compared with the turbulence data collected on Rattlesnake Mountain, and the comparison suggests that local scaling is a promising approach for the description of turbulence in slope flows. Based on the encouraging comparison of the Rattlesnake Mountain slope flow data to the model predictions, the model results have also been investigated for a variety of slope angles and wind directions.

24998 (PNL—6100-Pt.3, pp 15) **Surface heat fluxes during the 1984 Brush Creek field study.** Doran, J.C.; Hubbe, J.M. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

As part of the ASCOT experiment in the fall of 1984, four laboratories (PNL, the Wave Propagation Laboratory (WPL), Argonne National Laboratory (ANL), and the Atmospheric Turbulence and Diffusion Laboratory (ATDL)) measured surface eddy heat fluxes on the valley floor of Brush Creek. These measurements were intended to provide data that could be incorporated into energy budget calculations for the Brush Creek drainage system. Although the complex terrain, inhomogeneous surface cover, and generally limited fetch found in the vicinity of each of the measurement areas was expected to cause significant variations in heat fluxes from site to site, it was hoped that estimates could be made for representative flux values to be used in model and budget studies. Data for two nights, those of September 25-26 and September 29-30, 1986, have been compared for each of the sites.

24999 **Spatial interpolation of meteorological data in complex terrain using temporal statistics.** Porch, W.; Rodriguez, D. (Lawrence Livermore National Laboratory, Livermore, CA 94550). *Journal of Applied Meteorology;* **26**: No. 12, 1696-1708(Dec 1987). Contract W-7405-ENG-48.

Diagnostic wind field numerical models have significant difficulty developing representative wind velocities in complex terrain. A large part of this difficulty begins with the initial wind field interpolation. If this interpolated wind field does not closely represent the true winds, mass-consistent adjustments cannot retrieve the correct atmospheric flow patterns. Presently, the initial interpolation in diagnostic models is almost exclusively done using a simple one-over-separation-squared ($1/r^2$) interpolation algorithm. This algorithm uses the closest or larger number of measurements of the wind velocity closest to the interpolation location. In this paper, we explore different interpolation algorithms using not only the measurement field at the interpolation time, but also the statistical relationships between stations. These algorithms were tested with data from the 1980 Atmospheric Studies in Complex Terrain (ASCOT) sponsored by the Department of Energy. The results show that, while consistent (though in most cases marginal) improvement in interpolated wind speeds was obtained, little improvement was derived for interpolated wind direction.

25000 **Approach to adjusting climatological time series for discontinuous inhomogeneities.** Karl, T.R.; Williams C.N. Jr. (National Climatic Data Center, National Environmental Satellite Data and Information Service, National Oceanic & Atmospheric Administration, Asheville, NC 28801). *Journal of Applied Meteorology;* **26**: No. 12, 1744-1763(Dec 1987).

A method is described whereby climatological time series of temperature and precipitation can be adjusted for station inhomogeneities using station history information. The adjusted data retains its original scale and is not an anomaly series. The methodology uses the concepts of relative homogeneity and standard parametric (temperature) and nonparametric (precipitation) statistics. The technique has been tested in Monte Carlo simulations, and is shown to produce climatological time series more consistent with the concept of a homogeneous climate record than would otherwise be the case. Additionally, the technique provides an estimate of the confidence interval associated with each adjustment. It has been applied to over 1200 stations in the United States. In many instances the

adjustments in temperature time series are substantial (as large as actual climate fluctuations during the twentieth century) often leading to a more consistent pattern of regional climate change than would otherwise be surmised from inspection of the unadjusted data.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 24070, 24238, 24239, 24240, 24250, 24251, 24564, 24605, 24606, 24608, 24861, 24866, 25048, 25049, 25690

25001 **(BNL—40450) Status of US information on emissions, emission control technologies, and emission models for IEA/ETSAP/FEEST.** Hill, D.; Kroon, M.W.; Meinhold, A.F.; Winstanley, D. (Brookhaven National Lab., Upton, NY (USA)). 12 Jun 1987. Contract AC02-76CH00016. 67p. (CONF-8706256—1). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004593/JAW.

From 1. FEEST meeting; Upton, NY, USA (24 Jun 1987).

The US Department of Energy is a signatory to the Implementing Agreement for a Programme of Energy Technology Systems Analysis (ETSAP) of the International Energy Agency (IEA). Annex III, International Forum on Energy Environment Studies (FEEST), is a three-year project under ETSAP which began on 1 October 1986. Its major concern is how various environmental constraints (e.g., SO_2 and NO/sub x/ emissions) would affect the pattern of fuel and technology use and the choice and timing of implementation of abatement technologies. Under Annex III, the participating countries are responsible for, among other things, collecting and reporting: national data on emission release and emission control technologies; information on national reference energy system (RES) structure and related data. In accordance with the Operating Agent's Preliminary Program of Work, 12 December 1986, this information is presented at the Spring 1987 workshop. The following report is the written contribution of the US participant to the first FEEST meeting, held at Brookhaven National Laboratory on 24 through 30 June 1987. 11 refs., 17 figs., 12 tabs.

25002 (BULBW—1, pp 62-69) **Atmospheric trace materials from the dynamic and the energy point of view.** Platt, U. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Atmosphaerische Chemie). 1987. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752227/JAW. (CONF-8611224—).

From Forum on impact of radioactive materials on the atmospheric pollutant inventory and on the radioactivity uptake by plants; Stuttgart, F.R. Germany (7 Nov 1986).

The most important main components and trace materials of the atmosphere with their concentration ratios and the mean duration are introduced. The concentration ratios of the trace materials are not in thermodynamic equilibrium with the main constituents nitrogen and oxygen. The concentrations are set by supply and decay. These occur due to emission into the air, photo-chemical processes and radio-chemical reactions by isotopes. A comparison of photo- and radio-chemical trace material production is carried out.

25003 (BULBW—1, pp 89-105) **Do higher radioactivity levels in the air lead to a measurable change of the level of 'conventional' trace materials?.** Weiss, W.; Stockburger, H.; Sartorius, H.; Rath, H.K. (Bundesamt fuer Zivilschutz, Freiburg, Germany, F.R. Inst. fuer Atmosphaerische Radioaktivitaet). 1987. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752227/JAW. (CONF-8611224—).

From Forum on impact of radioactive materials on the atmospheric pollutant inventory and on the radioactivity uptake by plants; Stuttgart, F.R. Germany (7 Nov 1986).

Measured series of radioactivity concentrations of selected radionuclides and the concentrations of the trace materials ozone, SO/sub 2/, NO/sub 2/, dust and number of condensation nuclei are introduced. The data were obtained at places where comparatively high radioactivity concentrations in the air and/or the ground radiation were observed either permanently or for a short period due to the accident at Chernobyl. The values of dose rate and the activity concentration of the air observed at these places are above the natural value and also above the values which one would expect, even with the least favourable assumption on emisssion from a nuclear power station and the atmospheric spread at the least favourable point. In spite of these boundary conditions, a causal connection between the dose or the activity concentration in the air and the concentration of the above-mentioned conventional trace substances could in no case be found.

25004 **(CONF-871204—4) Atmospheric carbon dioxide and the global carbon cycle: The key uncertainties.** Peng, T.H.; Post, W.M.; DeAngelis, D.L.; Dale, V.H.; Farrell, M.P. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 21p. NTIS, PC A03. Order Number DE88005059/JAW.

From 8. Miami international conference on alternative energy sources; Miami Beach, FL, USA (14 Dec 1987).

The biogeochemical cycling of carbon between its sources and sinks determines the rate of increase in atmospheric CO_2 concentrations. The observed increase in atmospheric CO_2 content is less than the estimated release from fossil fuel consumption and deforestation. This discrepancy can be explained by interactions between the atmosphere and other global carbon reservoirs such as the oceans, and the terrestrial biosphere including soils. Undoubtedly, the oceans have been the most important sinks for CO_2 produced by man. But, the physical, chemical, and biological processes of oceans are complex and, therefore, credible estimates of CO_2 uptake can probably only come from mathematical models. Unfortunately, one- and two-dimensional ocean models do not allow for enough CO_2 uptake to accurately account for known releases. Thus, they produce higher concentrations of atmospheric CO_2 than was historically the case. More complex three-dimensional models, while currently being developed, may make better use of existing tracer data than do one- and two-dimensional models and will also incorporate climate feedback effects to provide a more realistic view of ocean dynamics and CO_2 fluxes. The instability of current models to estimate accurately oceanic uptake of CO_2 creates one of the key uncertainties in predictions of atmospheric CO_2 increases and climate responses over the next 100 to 200 years. 60 refs., 1 fig., 2 tabs.

25005 **(CONF-880351—1) Isotope studies to determine dry deposition of sulfate to deciduous and coniferous trees: Final draft.** Garten, C.T. Jr. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006182/JAW.

From NAPAP atmospheric chemistry task group review; Knoxville, TN, USA (13 Mar 1988).

Experiments have been conducted at two locations near Oak Ridge, Tennessee, with radioactive ^{35}S (87 day half-life) to examine the cycling behavior of sulfur in yellow poplar (Liriodendron tulipifera), red maple (Acer rubrum), and loblolly pine (Pinus taeda) trees. Some findings pertain to methods development for estimating dry deposition of sulfur to forest canopies and the magnitude of sulfur emissions from natural sources (Task II). We will determine through field studies, the internal cycling, storage, and biogenic emission of sulfur, as traced by $^{35}SO_4^{2-}$, in environments impacted by atmospheric sulfate deposition; and will determine through isotope dilution studies, the contribution of foliar leaching and dry deposition to net throughfall (NTF) sulfate concentrations beneath deciduous and coniferous trees in such environments. 3 refs., 2 figs., 1 tab.

25006 **(CONF-8510250—2) Report of Atmospheric-Canopy Exchange Panel.** Lindberg, S.E.; Samson, P.J.; Hornig, J.F. (Oak Ridge National Lab., TN (USA); National Center for Atmospheric Research, Boulder, CO (USA); Dartmouth Coll., Hanover, NH (USA). Dept. of Chemistry). May 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88004478/JAW.

From Department of Energy (DOE) meterology workshop; Lake Placid, NY, USA (1 Oct 1985).

The objectives of the Panel were to consider the exchange of the most basic constituents which define air/surface interactions (e.g., momentum, heat, water vapor) and determine limitations in

our ability to measure and model these interactions on the scale of leaves to trees. We then considered specific atmospheric constituents both deposited to and emitted from the canopy, defined limitations of current approches, and listed needs for new research to better understand, measure, and predict these interactions with forest canopies over a similar scale. Finally, we defined problems and developed approaches for dealing with the issue of providing landscape scale estimates of air/canopy exchanges. To tie these thoughts together, we developed a research program to deal with the major research needs perceived by the group.

25007 (CONF-8711135—1) **The use of branch level measurements in evaluating whole plant responses to air pollutants.** McLaughlin, S.B. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005060/JAW.

From Workshop on the use of branch exposure techniques in air pollution studies; Boulder, CO, USA (11 Nov 1987).

The use of branch exposure or branch monitoring techniques to study responses of large trees to air pollutants offers experimental advantages that must be weighed against some potentially significant limitations. Advantages include ease of pollutant exposure and monitoring physiological changes that can advance our current understanding of responses of carbon and water relations of foliage to well defined pollution stress regimes. Disadvantages are the uncertainties regarding the degree to which branch level responses represent responses to be expected when whole trees, including root systems, are exposed to chronic pollution stress. The influence of pollutants on carbon allocation including photosynthesis, respiration, and translocation represents one area of information need that can be productively addressed at the branch level to provide information of relevance to understanding how large trees respond to pollutants under field conditions. 26 refs., 4 figs., 2 tabs.

25008 (DOE/CH/10093—6, pp 218) **Air quality modeling of emissions from prescribed burning.** Shah, J.J. (Nero & Associates, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective of this project is to develop a tool to ensure that ambient air quality standards are not exceeded and nuisance intrusions are minimized. A three phase study plan has been developed for use in calibrating the models: (1) measurements of ambient air quality pollutants will be taken for dispersion models; (2) four to six burns will be selected for modeling; and (3) estimates of air pollutant concentrations (generally downwind) from prescribed burn operations, which apply to varying roughness of terrain, will be determined. In 1986 the sampling equipment was assembled, and sampling procedures were developed and prepared. A combination of high fire danger and unfavorable weather conditions made the burning of slash units impossible in the 1986 burn season. A revised study plan is currently being prepared.

25009 (DOE/CH/10093—6, pp 226) **Mitigation of prescribed fire atmospheric pollution through increased utilization of hardwoods, piled residues, and long-needled conifers.** Sandberg, D.V. (Forest Service, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

A three phase sampling program has been established to obtain the data needed: (1) combustion efficiency and emissions characteristics sampling for YUM (yarded unmerchantable material) piles of second- and old-growth western Washington conifers, (2) sampling of red alder slash consumption and emissions characteristics at broadcast burn sites, and (3) sampling of east-slope conifer stands (diseased lodgepole pine-dominated mixed-conifer stands). Measurements of hardwood consumption are ahead of schedule. The relationship of woody fuel consumption to woody fuel moisture in hardwood slash has been found to be surprisingly similar to conifer slash. Results from analytical laboratories for emissions characterization of carbon concentrations and trace elements from 1985 burns are completed. Emissions source strength sampling is continuing.

25010 (DOE/NBB—0082) **The prospect of solving the CO_2 problem through global reforestation.** Marland, G. (Oak Ridge Associated Universities, Inc., TN (USA); Oak Ridge National Lab., TN (USA)). Feb 1988. Contract AC05-84OR21400;AC05-76OR00033. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006256/JAW.

One short-term approach to limit the increase in atmospheric CO_2 would be to stimulate the growth of forests to take up in woody matter enough carbon to balance the discharge of CO_2 from fossil fuel burning. This study evaluated the extent to which the area and/or net growth rate (mean annual increment) of global forests would need to be enhanced in order to remove an additional 5 x 10^9 tons of carbon per year from the atmosphere. Although it is physically possible to plant large areas of new plantation and/or to stimulate tree growth via advanced silviculture techniques, conflicts in land use and resource allocation are quickly encountered in efforts of sufficient magnitude. The scale of the effort required is approximately equal to doubling the net annual yield of all of the world's closed forests or planting new fast growing forests over an area equivalent to the total of global forest clearing to date. The cost of such a scheme is immense but it needs to be compared with the costs of other approaches to dealing with atmospheric CO_2 or of coping with the attendant changes in climate. It is clear that although it is impractical to think in terms of solving the CO_2 problem through forestry alone, forestry could play a significant role. 101 refs., 8 figs., 16 tabs.

25011 (LA-UR—88-113) **Numerical simulations of long-range pollutant transport from coast to inland mountainous regions.** Yamada, Tetsuji; Bunker, S.S.; Niccum, E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-880463—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005383/JAW.

From 8. symposium on turbulence and diffusion of the American Meterological Society; San Diego, CA, USA (1 Apr 1988).

Kurita and Ueda (1986) presented an example of the long-range transport of pollutants which frequently occurs in summer in Japan light gradient wind conditions. High concentrations of photochemical oxidants were observed in late evenings in the mountainous region approximately 160 km northwest from the large industrial zone located along the Tokyo bay. Pollutants were apparently transported by the large-scale circulations produced by the combination of southwesterly valley winds induced by thermal lows located in the mountain ranges, and southerly sea-breeze circulations in the Pacific Ocean coastal region (Kurita et al., 1985). We wish to stimulate and evaluate the relative importance of these circulations by using a time dependent, three-dimensional mesoscale model, HOTMAC, High Order Turbulence Model for Atmospheric Circulations. 7 refs., 4 figs.

25012 (LBL—24400) **FTIR [Fourier transform infrared] and ion chromatographic sulfate analysis of ambient air samples.** Pollard, M.; Jaklevic, J.; Howes, J. (Lawrence Berkeley Lab., CA (USA); Environmental Monitoring and Services, Inc., Camarillo, CA (USA)). Oct 1987. Contract AC03-76SF00098. 24p. (CONF-871055—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005753/JAW.

From 3. international conference on carbonaceous particles in the atmosphere; Berkeley, CA, USA (5 Oct 1987).

Fourier transform infrared (FTIR) spectrometry has been evaluated as a method for determining the sulfate concentration of ambient aerosol particulate samples. Samples were collected on Teflon filters. The filters were analyzed for sulfate by both FTIR and Ion Chromatography (IC). There is good agreement between sulfate analysis by IC and analysis of the FTIR transmission spectra of the air filters. The difficulties incurred during background subtraction of the infrared spectra are described. 12 refs., 4 figs.

25013 (NP—8770082) **Pollutant emissions of private vehicles, 1950-2000.** (Bundesamt fuer Umweltschutz, Bern (Switzerland)). Nov 1986. 271p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88770082/JAW.

The pollutant emissions of private passenger and load transport are reviewed for 1950 through 1984 and forecasted through 2000. Date acquisition and model calculations were performed by the Federal Environmental Office in cooperation with the Technical Office for Transportation Problems.

25014 (NP—8770091, pp 13-26) **Natural gas helps to reduce pollution.** Holle, T. (Ruhrgas A.G., Essen, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770091/JAW.

Erdgas-Information. Industrie.; No. 14.

In Natural gas in the glass industry. Exchange of experience on economically efficient and non-polluting techniques for producing industrial glass.

The major pollutants (carbon monoxide, sulfur oxides, solids, nitric oxides) which occur in the process of using natural gas in industrial furnaces are described. The emissions are evaluated on the basis of the development of the emission of pollutants in West Germany from 1966-1982. Primary and secondary measures for the reduction of emissions from industrial furnaces are discussed. The legal and administrative framework for air pollution abatement is explained with the help of definitions from the Clean Air Technical Guide (TA Luft). Limiting values for emissions from glass melting processes and monitoring measurements are introduced. (HLN).

25015 **(NP—8770105) Numerical simulation of an exhaust plume near the source, and of regional and interregional pollutant transport.** Bruecher, L. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich 6 - Mechanik). 17 Dec 1982. 252p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88770105/JAW.

The author developed a three-dimensional, transient Eulerian grid model simulating the diffusion of dry emissions with momentum and buoyancy near the source, and a three-dimensional, time-dependent Lagrangian trajectory diffusion model for large-scale emitters and total emissions. The two models can be combined to obtain the off-gas plume near the source and, in consideration of plume end elevation, concentration distribution, and plume size, a vertically orientated area source.

25016 (PNL—6100-Pt.2, pp 47-48) **Remote aerosol measurement for wind tunnel tests.** Ligotke, M.W. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Environmental wind tunnels can provide opportunities to investigate the interactions of gaseous and particulate pollutants in simulated natural conditions. Formation, transport, fate, and effects of air-suspended particles are studied by scientists at PNL to provide new understanding of the ways man influences his environment. Of controlling importance in these investigations is the need to accurately measure the concentration, particle size, and chemical composition of the airborne contaminants studied in wind tunnel tests. Previously used methods of obtaining these data required that physical probes be placed within the test canopy. This method often led to inaccurate measurements, caused by limitations of the probes in collecting suspended particles, or from disturbance of the air flow by the probes themselves. One method of avoiding these problems, a remote laser particle analyzer, was modified and demonstrated in the wind tunnel of the PNL Aerosol Research Facility.

25017 (PNL—6100-Pt.3, pp 3-7) **Model simulation of plume dispersion in a narrow valley after sunrise.** Bader, D.C.; Whiteman, C.D. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

Numerical simulations of cross-valley plume dispersion in a strongly asymmetrically heated valley are reported those results are compared to measurements. The model results are used to describe the boundary layer mechanisms responsible for the observed plume structure and the effects of pollutant release height on cross-valley dispersion patterns are examined. 10 references, 2 figures.

25018 (PNL—6100-Pt.3, pp 11-12) **Evening transition in Colorado's Eagle Valley.** Whiteman, C.D. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

The buildup of temperature inversions and the development of nighttime local wind systems is of increasing interest in studies of air pollution potential in complex terrain areas. Observations of changes in atmospheric structure, which take place in the late afternoon and evening, allow the investigation of physical mechanisms by which mass and thermal energy are transferred in the valley atmosphere. These atmospheric processes were investigated in Colorado's Eagle Valley using tethered balloon observations, and initial conclusions were made concerning the mass and thermal energy transfers in the valley atmosphere. A recent paper documents the field study and analyses. A summary of the experiment and results is presented here.

25019 (PNL—6100-Pt.3, pp 19-31) **PRECP progress at PNL during FY-1986.** Slinn, W.G.N.; Busness, K.M.; Dana, M.T.; Easter, R.C.; Leslie, A.C.D.; Lindsey, C.G. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

This article presents an overview of PRECP's second year of progress at PNL, during FY-86, attempting to solve the acid rain problems identified by NAPAP. Progress has been made in the research areas of modeling, measurements, and applications, and separate sections, describe progress in these three areas.

25020 (PNL—6100-Pt.3, pp 31-44) **PNL's contribution to the PRECP-III (Syracuse) field studies.** Lindsey, C.G.; Busness, K.M.; Davis, W.E.; Luecken, D.J.; Thorp, J.M.; Slinn, W.G.N. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

This article summarizes PNL's contributions to the PRECP-III (Syracuse) field studies conducted during January and February, 1986, in upstate New York. PRECP-III was a cooperative effort involving staff from ANL, BNL, PNL, NOAA/Environmental Research Laboratories, and several universities. In addition to the experiments conducted to address the specific questions posed for the Syracuse studies, several missions were performed in cooperation with the Genesis of Atlantic Lows Experiment (GALE). This article describes the scientific goals established for the Syracuse experiments and discusses the strategy that was designed to satisfy those objectives. Mission summaries are presented along with some preliminary results from one experiment to demonstrate how completely the goals of PRECP-III were satisfied. 3 references, 5 figures, 5 tables.

25021 (PNL—6100-Pt.3, pp 44-53) **PNL's contribution to PRECP-IV (GALE) field studies.** Leslie, A.C.; Busness, K.M.; Dana, M.T.; Thorp, J.M.; Slinn, W.G.N. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

The fourth PRECP field program, PRECP-IV, took place over the 2-month period of January 15 to March 15, 1986. PRECP-IV was based at Raleigh-Durham North Carolina, and the program was designed to run concurrently with GALE. The basic objectives of PRECP-IV were to study the processing and wet deposition of chemical species (in particular, sulfur and nitrogen) at three scales: (1) for rainbands within frontal storms, (2) for entire frontal storms, and (3) for the regional scale. PRECP-IV was constructed to take advantage of the opportunity presented by the GALE meteorological measurements. Thus, PERCP-IV was a chemical measurement program within the experimental domain of GALE. The core objectives of GALE were (1) to describe the airflow, mass, and moisture fields in East-Coast winter storms, with special emphasis on regional-scale and air-sea interaction processes, (2) to understand the physical mechanisms controlling the formation and rapid development of these storms, and (3) to develop and test computerized models for their prediction.

25022 **(PNL—6398) A review of existing models and methods to estimate employment effects of pollution control policies.** Darwin, R.F.; Nesse, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 40p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006933/JAW.

The purpose of this paper is to provide information about existing models and methods used to estimate coal mining employment impacts of pollution control policies. The EPA is currently assessing the consequences of various alternative policies to reduce air pollution. One important potential consequence of these policies is that coal mining employment may decline or shift from low-sulfur to high-sulfur coal producing regions. The EPA requires models that can estimate the magnitude and cost of these employment changes at the local level. This paper contains descriptions and evaluations of three models and methods currently used to estimate the size and cost of coal mining employment changes. The first model reviewed is the Coal and Electric Utilities Model (CEUM), a well established, general purpose model that has been used by the EPA and other groups to simulate air pollution control policies. The second model reviewed is the Advanced Utility Simulation Model (AUSM), which was developed for the EPA specifically to analyze the impacts of air pollution control policies. Finally, the methodology used by Arthur D. Little, Inc. to estimate the costs of alternative air pollution control policies for the Consolidated Coal Company is discussed. These descriptions and evaluations are based on information obtained from published reports and from draft documentation of the models provided by the EPA. 12 refs., 1 fig.

25023 **(PNL-SA—13140) Economic valuation of acidic deposition damages: Preliminary results from the 1985 NAPAP [National Acid Precipitation Assessment Program] damage assessment.** Callaway, J.M.; Darwin, R.F.; Nesse, R.J. (Pacific Northwest Lab., Richland, WA (USA)). 13 Sep 1985. Contract AC06-76RL01830. 40p. (CONF-8509445—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005690/JAW.

From International symposium on acid deposition; Muskoka, Canada (20 Sep 1985).

This paper identifies methods used to evaluate the economic damages of acid deposition in the 1985 Damage Assessment being coordinated by the National Acid Precipitation Program. It also presents the preliminary estimates of economic damages for the Assessment. Economic damages are estimated for four effect areas: commercial agriculture and forests, recreational fishing and selected types of materials. In all but the last area, methods are used which incorporate the behavioral responses of individuals and firms or simulated physical damages to resources at risk. The preliminary nature of the estimated damages in each area is emphasized. Over all, the damage estimates should be interpreted with caution. 44 refs., 6 figs., 5 tabs.

25024 **(UCRL—53847) Using the Oeresund experimental data to evaluate the ARAC [Atmospheric Release Advisory Capability] emergency response models.** Gudiksen, P.H.; Gryning, S.E. (Lawrence Livermore National Lab., CA (USA)). 15 Dec 1987. Contract W-7405-ENG-48. 18p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005879/JAW.

The capability of the three-dimensional MATHEW-ADPIC atmospheric transport and diffusion models to simulate pollutant dispersion in a coastal environment was evaluated by utilizing data from a series of meteorological and tracer experiments conducted across the Oeresund strait between Denmark and Sweden. These experiments, which were designed to study atmospheric dispersion processes associated with flows over cold water and warm land surfaces, included the release of a tracer from the upwind coastline. This tracer was transported over the Oeresund strait and subsequently sampled along the downwind coastline. The results of the comparisons between the simulated and the measured tracer concentrations reveal that in general the calculated maximum concentrations are higher than those measured by factors of up to 4. A statistical analysis of the individual sample comparisons indicated that approximately 50% of the comparisons are within a factor of 4. This overprediction is believed to be due to the development of a shallow stable layer over the cold water surface. 17 refs., 11 figs., 1 tab.

25025 **(UCRL—98087) Observational and theoretical studies of greenhouse climate effects.** Taylor, K.E.; Grotch, S.L. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 16p. (CONF-871204—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006237/JAW.

From 8. Miami international conference on alternative energy sources; Miami Beach, FL, USA (14 Dec 1987).

The carbon dioxide concentration in the atmosphere has increased by about 25% over the last 150 years and will surely continue to increase as a result of fossil fuel combustion. Enhancement of the atmospheric effect by elevated levels of CO_2 and other trace gases may over the next century increase global average surface air temperature by a few degrees Celsius to levels unprecedented in human history. Even eliminating emissions of CO_2 will not prevent global climate change because the combined greenhouse effect of less abundant but radiatively important gases such as methane and chlorocarbons is likely to be just as large as the impact of projected increases in carbon dioxide concentration. Quantitative estimates of future warming that could result from continued increases in greenhouse gas concentrations come from sophisticated mathematical models, which are the modern climatologists' primary prognostic tool. The current limitations and uncertains in these model results, however, prevent definitive predictions of the regional climatic responses that make up the projected global change. Deficiencies in the historical climate record prevent confirmation of the climate model predictions, but future research offers the potential for improved understanding. 25 refs., 10 figs.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 24201, 24202, 24441, 24505, 24506, 24530, 24560, 24561, 25002, 25003, 25055, 25061, 25069

25026 **(CEA-DSN—440) Vademecum of atmospheric transfers.** Doury, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Surete Nucleaire). Jul 1981. 64p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752164/JAW.

In this paper, after a brief presentation of the method used, the author gives useful solutions by curves, abacuses and formulas for concentrations and fallouts. The conditions of use are discussed. Examples of use are given.

25027 **(CFFTP-G—85039) International comparison of computer codes for modelling the dispersion and transfer of tritium released to the atmosphere.** Russell, S.B.; Kempe, T.F.; Donnelly, K.J. (Ontario Hydro Research Lab., Toronto (Canada)). (Canadian Fusion Fuels Technology Project, Toronto, Ontario). May 1985. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701793/JAW.

Computer codes for modelling the dispersion and transfer of tritium released to the atmosphere were compared. The codes originated from Canada, the United States, Sweden and Japan. The comparisons include acute and chronic emissions of tritiated water vapour or elemental tritium from a hypothetical nuclear facility. Individual and collective doses to the population within 100 km of the site were calculated. The discrepancies among the code predictions were about one order of magnitude for the HTO emissions but were significantly more varied for the HT emissions. Codes that did not account for HT to HTO conversion and cycling of tritium in the environment predicted doses that were several orders of magnitude less than codes that incorporate this feature into the model. A field experiment consisting of the release of tritium gas and subsequent measurements of tritium concentrations in the environment has been recommended to validate the tritium transport models and code predictions and to refine the values of key parameters in the models. It is further recommended that the results from a field experiment be used in a follow-up code validation study to confirm which conceptual model and derived computer code provides the best representation of tritium transport in the real system.

25028 (KFK—4223, pp 157-171) **Systems for nuclear reactor monitoring - concepts and realisation.** Rudolf, A. (Dornier System G.m.b.H., Friedrichshafen, Germany, F.R.). Mar 1987. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88752262/JAW. (CONF-8609392—).

From Colloquium on applications of information technology in the environmental area; Karlsruhe, F.R. Germany (30 Sep 1986).

The functional construction, software structure and measures against the loss of data and falsification of a nuclear reactor monitoring (NRM) system are described using the example of the NRM Baden-Wuerttemberg. A general evaluation follows this for the concepts of the NRM systems with direct measurements, decentralised station computers and decentralised architecture. Finally, the self-monitoring system of the THTR and the NRM system for Rheinland-Pfalz and Baden-Wuerttemberg are introduced.

25029 (OH—84-134-K) **Plan for research by the atmospheric research section in support of Ontario Hydro's nuclear activities.** Ogram, G.L.; Melo, O.T. (Ontario Hydro Research Lab., Toronto (Canada)). 18 May 1984. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701960/JAW.

A plan for nuclear studies by the Atmospheric Research Section is presented. The need for research is discussed and research objectives are established. Recommended research activities include the study of fundamental processes governing the fate of emissions released to the atmosphere by Hydro's nuclear facilities and the development of improved transport models describing the fate of these emissions. A Sectional goal of providing technical expertise in the atmospheric sciences in support of Ontario Hydro's present and future nuclear activities is proposed. The plan covers a five-year time frame (1984-1988).

25030 (OH—84-137-K) **Study of the dispersion climatology of the Pickering area.** Tam, Y.T. (Ontario Hydro Research Lab., Toronto (Canada)). 9 May 1984. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701961/JAW.

A year-long preliminary experimental program was carried out in the Pickering NGS area to collect meterological information which is important in determining dispersion and transport of air pollutants. Data were collected by acoustic sounders, net pyrradiometers, anemometers and thermocouples. These data were analyzed to give seasonal and diurnal frequencies of occurrence of wind velocity, atmospheric stability, inversions and the formation of thermal internal boundary layers. An advection model was developed to illustrate the applicability of data collected in this study in predicting the growth rate of the thermal internal boundary layer. The likely behaviour of an emitted plume was discussed in terms of the local meterological conditions for two selected cases. It is concluded that continuous shoreline fumigation and trapping may occur over the Pickering area. However, looping and lofting may also be comparably important, especially for low-level releases. Numerical modelling and tracer experiments will be essential to gain further insight into microscale effects on the dispersion climatology of the Pickering area.

25031 (PNL—6100-Pt.3, pp 55-67) **Field studies of the atmospheric processing of radionuclides released at Chernobyl.** Slinn, W.G.N.; Brodzinski, R.L.; Busness, K.M.; Dana, M.T.; Davis, W.E.; Elderkin, C.E.; Hensley, W.K.; Lepel, E.A.; Leslie, A.C.D.; Perkins, R.W.; Roberston, D.E. Jun 1987. NTIS, PC A 05. Order Number DE88000665/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.

This report gives a summary description of the goals and execution of field studies to characterize the radionuclides released from Chernobyl and to examine their long-range atmospheric transport and processing. Starting on April 28, 1986, an intensive planning and preparation effort was mounted over a very short time intercept and characterize the Chernobyl plume on its arrival over the western US. During the execution of these studies, they had very little firm information (beyond their own measurements and trajectory estimates) to confirm the location of the Chernobyl plume. On May 20, 1986, the studies were terminated, after extensive airborne sampling of air, cloud water, precipitation, soil, and vegetation as the plume traversed the western and central US and moved into Canada.

25032 **Measurement of uranium aerosols in high explosive environments.** Sandoval, R.P.; Apple, M.L. (Sandia National Labs., P.O. Box 5800, Albuquerque, NM 87185). pp 1 of Proceedings of the 4th Miami international symposium on multi-phase transport particulate phenomena (condensed papers). Veziroglu, T.N. Coral Gables, FL; University of Miami (1987). (CONF-861204—). Contract AC04-76DP00789.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

An aerosol-sampling package was designed and built to measure particles produced in high-pressure, high-temperature environments resulting from detonations of high-explosive devices. The sampling package is capable of withstanding the shock (peak pressures up to 500 psig), high temperatures, and high-velocity shrapnel produced from such an explosion. The instrumentation of the package provides data on airborne particle mass, size distribution, and particle morphology of the explosively produced aerosols. Ambient pressure and temperature are also provided as a function of time (for time scales from milliseconds to ≦5 seconds). The sampling packages were recently used to support a research program at Sandi National Laboratories for assessing the health and economic consequences that could result from the dispersal of potentially toxic aerosols from high-explosive devices. A full-scale test was conducted to characterize the shrapnel, particles, and aerosols produced during a full-scale test of a high-explosive device. The sampling packages were used to sample uranium aerosols produced from the detonation of the high-explosive device. Mass and size distributions of the uranium particles present in the ensuing fireball were measured, and morphology of the sampled uranium particles was determined. These measurements, together with other shrapnel and fragment measurements performed during the test, were used to predict the characteristics of the respirable component of the resulting plume as well as those of the larger nonrespirable particles and fragments produced from the detonation. The data obtained using these sampling packages are presented, and the characteristics and predicted behavior of the uranium aerosols produced from the explosion are discussed.

5005 Site Resource And Use Studies

25033 (EC/E/AES—NOGAP/C17) **Beaufort Sea specialized data base.** Parker, N. (Environment Canada, Edmonton, Alberta. Atmospheric Environment Service). Mar 1987. 16p. NOGAP Secretariat, Constitutional Development and Strategic Planning Branch, Indian and Northern Affairs Canada, Les Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H4; $N/C.

The main objective was to increase the Beaufort Sea meteorological data base. These additional data will then aid in the development of improved climatologies and support the provision of real time weather warnings and advisories for the exploration and production area. The network, as of March 1987, is described. Logistics of establishing the network are examined along with the configuration of a typical station. Some of the problems encountered, with implemented or proposed solutions, are included. Monthly descriptive statistics for the network are presented. 3 figs., 1 tab.

25034 (SCSIN—U-2-1-83) **Instruments for meteorological measurement.** (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Aug 1983. 7p. (In French). (SIN—A-4212-83). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752179/JAW.

The Fundamental Safety Rules applicable to certain types of nuclear installation are intended to clarify the conditions of which observance, for the type of installation concerned and for the subject that they deal with, is considered as equivalent to compliance with regulatory French technical practice. These Rules should facilitate safety analysises and the clear understanding between per-

sons interested in matters related to nuclear safety. They in no way reduce the operator's liability and pose no obstacle to statutory provisions in force. For any installation to which a Fundamental Safety Rule applies according to the foregoing paragraph, the operator may be relieved from application of the Rule if he shows proof that the safety objectives set by the Rule are attained by other means that he proposes within the framework of statutory procedures. Furthermore, the Central Service for the Safety of Nuclear Installations reserves the right at all times to alter any Fundamental Safety Rule, as required, should it deem this necessary, while specifying the applicability conditions. This present rule has for objective to determine the means for meteorological measurement near a site of nuclear facility in which there is not a PWR power plant.

25035 **(UCID—21277) Report on environmental effects at Yuma Proving Ground from continued testing of projectiles containing beryllium and depleted uranium.** Shinn, J.H.; Sharmer, L.A.; Cederwall, R.T.; Novo, M.G.; Mitchell, C.S. (Lawrence Livermore National Lab., CA (USA)). Feb 1988. Contract W-7405-ENG-48. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006589/JAW.

The purpose of this report is to determine, from the available information, the potential environmental effects at Yuma Proving Ground (YPG), resulting from further testing of surface-burst artillery projectiles (XM785) containing amounts of beryllium (Be) and depleted uranium (DU). A model was applied to assess the downwind deposition and air concentrations of Be and DU during actual tests with the XM753 and XM785 at YPG. In addition, one single, static test of an XM785 was conducted at Tonopah Test Range. The potential effects of continued testing of devices such as the XM753 and XM785 appear to be insignificant, providing that prudent mitigations and environmental management practices are carried out. 44 refs., 17 figs., 11 tabs.

5006 Regulations

REFER ALSO TO CITATION(S) 24505, 24506, 24526, 24527, 25014

25036 **(EML—498) Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division: Quality Assessment Program.** Sanderson, C.G.; Feiner, M.S. (USDOE Environmental Measurements Lab., New York). 1 Sep 1987. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006214/JAW.

This report presents the results from the analysis of the 26th set of environmental quality assessment samples (QAP XXVI) that were received on or before August 3, 1987. This Quality Assessment Program (QAP) is designed to test the quality of the environmental measurements being reported to the Department of Energy by its contractors. Since 1976, real or synthetic environmental samples that have been prepared and thoroughly analyzed at the Environmental Measurements Laboratory (EML) have been distributed at first quarterly and then semi-annually to these contractors. Their results, which are returned to EML within 90 days, are compiled with EML's results and are reported back to the participating contractors 30 days later. A summary of the reported results is available to the participants 3 days after the reporting deadline via a modem-telephone connection to the EML computer.

25037 **(EML—503) Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division: Quality assessment program.** Sanderson, C.G.; Feiner, M.S. (USDOE Environmental Measurements Lab., New York). 4 Jan 1988. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006212/JAW.

This report presents the results from the analysis of the 27th set of environmental quality assessment samples (QAP XXVII) that were received on or before December 3, 1987. This Quality Assessment Program (QAP) is designed to test the Quality of the environmental measurements being reported to the Department of Energy by its contractors. Since 1976, real or synthetic environmental samples that have been prepared and thoroughly analyzed at the Environmental Measurements Laboratory (EML) have been distributed, at first Quarterly and then semi-annually to these contractors. Their results, which are returned to EML within 90 days, are compiled with EML's results and are reported back to the participation contractors 30 days later. A summary of the reported results is available to the participants 3 days after the reporting deadline via a modem-telephone connection to the EML computer.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

25038 **(ORNL/M—332) Environmental Sciences Division long-range plan (FY 1987-FY 1992).** (Oak Ridge National Lab., TN (USA)). Apr 1987. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005787/JAW.

This third long-range plan of the Environmental Sciences Division (ESD) addresses the five-year period 1987 to 1992. It is a statement of the characteristics of the Division - the scope of its disciplinary research and development (R and D) activities, its unique staff resources, and its exceptional research facilities and support services. This strategic plan addresses the long-term scientific development and programmatic foci of the Division's goals. The near-term implementation of these goals through meeting specific tactical objectives is articulated in a separate, succinct action plan, updated biennially to reflect changing programmatic priorities and key new initiatives planned. 11 refs., 5 figs., 4 tabs.

5101 Basic Studies

25039 (PNL—6100-Pt.2, pp 1-3) **Effect of natural disturbance on vegetation and soil moisture in the shrub-Steppe.** Link, S.O.; Thiede, M.E. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

To predict the effects of disturbance in terrestrial systems, it is necessary to understand the relationship between yearly soil-water extraction patterns and plant activity. Wildfires on the Arid Lands Ecology (ALE) Reserve during 1981 and 1984 have permitted PNL to examine the effect of temporary removal of surface vegetation on these relationships. Since the 1984 wildfire, plant growth has been monitored by sampling research plots for green leaf area and biomass. In addition, litter biomass has been determined to assess rate of biomass turnover.

25040 (PNL—6100-Pt.2, pp 3-5) **Remote sensing (Reflex): measuring bidirectional reflectance for vegetation characterization.** Beedlow, P.A.; York, J.E. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Satellite, aircraft, and ground measurements of solar spectral reflectance have been routinely used to study land cover. The usefulness of these measurements are being extended at several test areas on the Hanford Site. In most studies that use spectral reflectance to differentiate land cover types, the reflectance is assumed to be Lambertian. The reflectance of most land cover types is known to be non-Lambertian, but the actual angular dependence is not well known. Measurements of bidirectional reflectance (reflectance as a function of the angle of reflection) may be useful in characterizing landscape units. Bidirectional reflectance may be affected by cover type, plant or soil structure, leaf area, biomass, and/or other environmental factors. Field data gathered from the Hanford Site with a portable spectroradiometer are being used to determine the effects and uses of bidirectional reflectance, particularly to evaluate its usefulness in determining biomass, leaf area, and soil properties for the characterization of landscape units.

25041 (PNL—6100-Pt.2, pp 5-8) **Biotic transport processes in arid ecosystems.** Cadwell, L.L. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

A research program is being developed at the Arid Land Ecology (ALE) Reserve on the Hanford Site to measure and model the hydrologic cycle response as it relates to plant and animal processes in a natural, semiarid environment. Simulated rainfall is being applied to study plots in the shrub-steppe to view response and measure transport parameters.

25042 (PNL—6100-Pt.2, pp 8-9) **Installation of precision-weighing lysimeters for evapotranspiration measurements at Hanford's Arid Land Ecology Reserve.** Gee, G.W. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Precision-weighing lysimeters constructed during the past year, are being used to measure variations in evapotranspiration for distinct plant communities at the ALE Reserve. Monolith-type lysimeters are arranged in pairs and are located on a bunchgrass-dominated site (primarily Agropyron spicatum) and on an adjacent sagebrush-dominated site (Artemisia tridentata). Electronic scales continuously record weight changes that represent water loss via evapotranspiration or water gain from precipitation. Each lysimeter weighs about 7 metric tons and consists of an undisturbed block (monolith) of soil 1.5 m on a side and 1.7 m deep. As part of a comprehensive Watershed Research Facility on ALE, these unique lysimeters will provide information on soil water dynamics and energy balance needed to develop predictive models of the water-driven processes in arid regions.

25043 (PNL—6100-Pt.2, pp 35-36) **Dynamics of wild populations.** Eberhardt, L.L. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

For a number of years, this research has been concerned with large mammal population dynamics, in particular population regulation, a major unresolved issue in ecology. Most of the work has to be done through cooperative studies with management agencies and takes many years to complete. Thus, to address immediate problems, this research has focused on the top of the trophic levels, using field data to understand the forces regulating large animal populations. In the current year, work continued on the Yellowstone grizzly bear, a species classified as threatened under the Endangered Species Act and impacted by energy development. The research includes estimates of abundance and certain essential population parameters, such as reproductive and survival rates. Various kinds of models have been used in an effort to assess the available data.

25044 (PNL—6100-Pt.2, pp 36-38) **Quantifying energy-related effects on mobile species.** Skalski, J.R.; Simmons, M.A.; Robson, D.S.; Kosorok, M. (Cornell Univ., Ithaca, NY). Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Temporal and spatial variability is common to all natural systems. The elusive and secretive nature of mobile species makes the detection of these changes all the more difficult because direct observations and measurements are not feasible. Hence, population studies incorporate all the design and analysis problems of other environmental investigations, plus the parameter estimation difficulties encountered in dealing with wild populations. In addition, advances in sampling sessile components of the environment cannot always be directly transferred to the study of mobile species. However, the statistical methods for mobile species often provide a general framework for the broader class of environmental analyses. Research during the past year has focused on issues specific to wild populations, as well as environmental investigations in general. Research on design optimality for tag-recapture studies was extended to the design of studies that use indices to estimate abundance. In turn, these index studies are analogous to the design of soil or plant ecology investigations. Survival analysis of clinical data was also extended to the more general case of analyzing lifetime data for free-ranging populations. In both index and survival analysis, the statistical framework includes as special cases an analysis of more traditional biological or ecological data.

25045 (PNL—6100-Pt.2, pp 38-40) **Designs for environmental field studies.** Thomas, J.M.; Eberhardt, L.L. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

A shortcoming of current field studies in ecology and environmental science is that some study objectives cannot be evaluated experimentally. The prospects for conducting true, ecological experiments (without pseudoreplication) are not good without major methodological innovations. Thus, some of this research was focused on areas where existing data and circumstances might allow statistical hypothesis testing. A high potential for true replication was found to be available, using data from long-term studies or surveys conducted on state game management units. Thus, it is possible to statistically test hypotheses about populations, thereby settling questions rather than just endlessly discussing the data. In an attempt to provide a quantitative basis for the use of indices in ecological surveys, a study was conducted of the accuracy obtained when indices were estimated via double sampling. The initial effort to assess the prospects for calibrating indices by using either ratio estimation or double sampling is described.

25046 (PNL—6100-Pt.2, pp 48) **Remotely acquired thermal data for energy exchange in arid regions.** Beedlow, P.A. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

The objectives of this research are to determine how data from the Landsat 5 satellite can aid their understanding of the energy exchange processes affecting the heat and water balance of arid ecosystems, and to develop techniques to measure those processes over large regions. The data collected in FY 1986 will address these objectives more specifically by (1) producing a calibrated and verified map of soil and canopy temperatures for Hanford, and (2) developing and validating a model to predict latent heat flux from soil and canopy temperature data. Research proposed for FY 1987 will focus on establishing the relationships between satellite data and basic parameters of the energy budget for arid landscapes. Beyond FY 1987, research will address other key landscape processes, possibly including a new research program to develop methods using satellite data for measuring evapotranspiration from arid landscapes.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 24071, 24101, 24102, 24103, 24111, 24201, 24525, 24538, 25081, 25244

25047 (LA—11209-MS) **Site geology and hydrology of Technical Area 16, Area P.** Brown, F.; Purtymun, W.; Stoker, A.; Barr, A. (Los Alamos National Lab., NM (USA)). Feb 1988. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006028/JAW.

Two distinct units of the Quaternary Upper Bandelier Tuff were encountered during a geological investigation of Technical Area 16, Area P, at Los Alamos National Laboratory, Los Alamos, New Mexico. Unit 3, the uppermost unit encountered, consists of four distinct ashflows, and is characterized by a high degree of welding and low-moisture content. Unit 2, the lowermost unit encountered, is densely welded, and noticeably impeded drilling operations. The Water Canyon Fault Zone, which lies approximately 500 ft to the east of Area P, exhbits 10 to 15 ft of displacement in the subsurface with little surface expression apparent. No evidence for the existence of groundwater was detected. 14 refs., 4 figs., 1 tab.

25048 **(ORNL/M—463) Heavy metals in the environment: Volume 1.** Lindberg, S.E.; Hutchinson, T.C. (eds.). (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 506p. (CONF-870937—Vol.1). CEP Consultants, Ltd., 26 Albany St., Edinburgh EH1 3QH, UK. Order Number TI88006131/JAW.

From 6. international conference on heavy metals in the environment; New Orleans, LA, USA (15 Sep 1987).

This volume contains half the proceedings of the Sixth International Conference on Heavy Metals in the Environment, held in New Orleans, Louisiana, September 15-18, 1987. The papers are arranged in the order of presentation at the conference, beginning with the plenary session and ranging across diverse topics from neurotoxicity to marine chemistry. The major conference themes included analytical chemistry and speciation; human health; atmospheric, marine, and freshwater chemistry; sediments and soils; neurotoxicity of lead; forest cycling and effects; microbial interactions; metal tolerance; industrial wastes; and treatment technology. Because of the recent increase in research on acidic deposition and hazardous waste storage, new sessions have been added on acidity and metal interactions in forests, aluminum biogeochemistry, waste treatment and storage, and chemical kinetics and speciation. Individual papers are processed separately for the data base.

25049 **(ORNL/M—464) Heavy metals in the environment: Volume 2.** Lindberg, S.E.; Hutchinson, T.C. (eds.). (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 537p. (CONF-870937—Vol.2). CEP Consultants, Ltd., 26 Albany St., Edinburgh EH1 3QH, UK. Order Number TI88006132/JAW.

From 6. international conference on heavy metals in the environment; New Orleans, LA, USA (15 Sep 1987).

This volume contains half the proceedings of the Sixth International Conference on Heavy Metals in the Environment, held in New Orleans, Louisiana, September 15-18, 1987. The papers are arranged in the order of presentation at the conference, beginning with the plenary session and ranging across diverse topics from neurotoxicity to marine chemistry. The major conference themes included analytical chemistry and speciation; human health; atmospheric, marine, and freshwater chemistry; sediments and soils; neurotoxicity of lead; forest cycling and effects; microbial interactions; metal tolerance; industrial wastes; and treatment technology. Because of the recent increase in research on acidic deposition and hazardous waste storage, new sessions have been added on acidity and metal interactions in forests, aluminum biogeochemistry, waste treatment and storage, and chemical kinetics and speciation. Individual papers are processed separately for the data base.

25050 (PNL—6100-Pt.2, pp 13-15) **Soil and plant processes controlling cation behavior in terrestrial systems.** Wildung, R.E.; Cataldo, D.A.; Fredrickson, J.K. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

The environmental mobility and kinetics of inorganic pollutant solubilization, particularly for cations, are regulated directly and indirectly by specific biological processes. These processes, which are related to soil microbial, rhizosphere, and plant metabolic functions, alter the thermodynamic equilibria controlling cation speciation and complexation, and therefore alter cation behavior. Thus, an understanding of these biotic processes is essential in predicting the spatial and temporal mobility of elements after the terrestrial ecosystem is stressed physically or chemically. An integrated field and laboratory approach is used to define, assess, and quantify those processes which influence metal speciation in the near-surface environment.

25051 (PNL—6100-Pt.2, pp 21-23) **Subsurface chemistry of organic compounds.** Zachara, J.M.; Ainsworth, C.C. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Experimental investigations of multispecies solute interactions with subsoil and aquifer materials are being performed and described with chemical equilibrium models to improve predictions of contaminant migration in subsurface environments. Carefully selected organic compounds are used in combination with both mineral/hydrocarbonaceous surfaces varying in charge and hydrophobicity and subsurface materials of diverse properties to probe sorption and surface-catalyzed reactions. In keeping with these objectives, research over the past year has focused on (1) the limits of carbon-referenced sorption on subsurface materials, using a neutral, nitrogen-containing, aromatic compound; (2) the influence of dissolved cosolvent on the sorption of ionizable and neutral N-containing aromatic compounds by subsurface materials and clays; and (3) the sorption and surface complexation of N-containing aromatic compounds by amorphous silica. These studies have advanced their understanding of the relative contributions of electrostatic versus hydrophobic interactions and the importance of steric effects in the sorption process.

25052 (PNL—6100-Pt.2, pp 24-26) **Subsurface microbial phenomena.** Fredrickson, J.K.; Hicks, R.J. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Biological reactions have a major influence on organic contaminant persistence and transport in subsurface environments. In spite of this, knowledge of the identity and functions of microorganisms in the subsurface lags far behind that of the related fields of aquifer fluid dynamics and interfacial chemistry. Therefore, fundamental investigations are being conducted at PNL to probe the microbial diversity and physiological processes governing the fate of aromatic organic compounds in the subsurface. Research is focused on the microbial degradation of N-containing aromatic compounds as influenced by key physicochemical parameters, such as the solubility, concentration, and dipole moment of the organic contaminant; competing organic substrates; sorption reactions; and the oxidative state of the environment. Results of this research are expected to provide an improved understanding of the role of microorganisms in transformation and transport of organic contaminants in the subsurface.

25053 (PNL—6100-Pt.2, pp 26-28) **Fluid dynamics in subsurface systems.** Simmons, C.S. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

A sequential series of experiments is being performed to test the validity of fundamental scientific hypotheses that form the theoretical basis for modeling the subsurface movement of immiscible organic liquids. An intermediate-scale experimental facility is being assembled in which the subsurface flow behavior of organic chemicals will be studied. Benchmark experiments that demonstrate phenomena of immiscible multiphase flow will be performed in the facility. The experimental results will be used to support the development of validated computer models capable of predicting migration of organic chemical contaminants in aquifers. Measurements of pressure-saturation and permeability-saturation relationships for three-fluid phase flows are being obtained to drive simulations of the benchmark experiments used to test scientific hypotheses. Mathematical methods are also being derived to treat miscible transport when flow occurs in heterogeneous porous media.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 24147, 24160, 24165, 24168, 24169, 24188, 24434, 25092

25054 **(CEGB-TPRD/B—0887/R87) Solution method for compartment models of the environment using the numerical inversion of Laplace transforms.** Maul, P.R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jan 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752771/JAW.

It is shown that advantage can be taken of the structure of compartment models of the environment to develop an appropriate Laplace transform solution method. Such models can often be divided into a number of sub-models, and providing the number of compartments in each sub-model does not exceed about 10, the computational time required is not excessive. Larger models can often be reduced to systems of this size by taking account of those parts of the environment where local equilibrium is rapidly attained. For many situations, particularly where decay chains of radionuclides are considered, this method can actually show significant time savings over time-stepping solutions.

25055 **(CONF-871208—2) House characteristics associated with gamma radiation and radon daughter working levels in eastern Pennsylvania.** Stebbings, J.H.; Dignam, J.J.; Reilly, M.A.; Gerusky, T.M.; Hartman, T.T.; Anast, G.A. (Argonne National Lab., IL (USA); Pennsylvania Dept. of Environmental Resources, Harrisburg (USA). Bureau of Radiation Protection). 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005994/JAW.

From 4. international symposium on the natural radiation environment; Lisbon, Portugal (7 Dec 1987).

Working levels (WL) of radon daughters and γ measurements in basements are described for ~1200 houses near the Reading Prong. House variables studied included condition and construction materials of basement floors and walls, basement heights and areas, heating systems, air conditioning, water supply, and presence of drains and sump pumps. WL's were poorly predicted by house characteristics or γ measurements, while γ levels were well predicted by house characteristics and WL. Except for windowless basements, associated with both high γ andl high WL measurements, factors predicting high γ levels tended to be associated with low WL's and vice versa. Dirt basement floors and fieldstone basement walls were strongly associated with high γ levels, as were poor wall conditions in multivariate analyses. Gamma levels were low in electrically heated homes. High WL's were strongly associated with electric heat, low WL's with basement walls of fieldstone and/or in poor condition. Large house volumes and well water supply were also associated with higher WL's. 4 refs., 1 fig., 4 tabs.

25056 **(FLPU—86-6) Natural analogues of radionuclide migration: reconnaissance study of sites (May 1985-March 1986).** Hooker, P.J.; Ball, T.K.; Basham, I.R.; Bloodworth, A.J.; Roberts, P.D.; MacKenzie, A.B.; Scott, R.D.; Ivanovich, M. (British Geological Survey, Keyworth. Fluid Processes Research Group; Scottish Universities Research and Reactor Centre, Glasgow (UK); UKAEA Harwell Lab. Nuclear Physics Div.). (British Geological Survey, Keyworth. Fluid Processes Research Group; Department of the Environment, London (UK)). 1986. 26p. (DOE-RW—87.098). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752748/JAW.

Research into natural analogues of radionuclide migration provide data for supporting computer codes that describe the processes of transport and retardation. Such models are appropriate to the far-fields of shallow and deep radioactive waste repositories. The objective of this research project was to define locations within the UK and abroad worthy of detailed investigation. Site investigations and evaluations were carried out at a number of UK localities. The main focus of this survey has been on uraniferous veins in places at near surface where transport of uranium into sediments has occurred. Several uranium rich mineralisations associated with granite margins were visited in Cornwall, Devon and along the Solway Firth coast in Scotland; the disused U mine at South Terras in Cornwall and the coastal site at Needle's Eye near Dalbeattie are confirmed as future study sites. Results to hand from the sediments of Loch Lomand warrant further measurements of iodine and bromine in fresh cores.

25057 **(FRNC-TH—3181) Study of gas movements in soil by a nuclear method: geophysical application.** Filali-Jaouhari, K. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France)). Jul 1987. 112p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752161/JAW.

Thanks to the combination of its physico-chemical properties, radon is a signal of inner geophysical events. This work is meant to clear out a few methodological points in this field. The standardization of electronical set-ups of radon-222 measurements is studied. The different results obtained point out the measuring reproductibility of the whole calibrated set-ups, their good adaptation to field conditions and their speed in answering. The radon movement in soil is simulated. The simulation system is a 8.5 high and 30 cm wide column. We studied the influence of atmospheric parameters on radon migration, by qualitative and quantitative means. Observations showed that pressure and relative humidity had no or nearly no effects on this migration, temperature only seems to influence it. Then we realized a theoretical and experimental model in order to measure the speed variation of interstitial gases in soil (speed between 5 and 500 μm/s). The very encouraging results of the experimental realization showed how feasible it was.

25058 **(GSF—34/86) Experimental investigation of the migration of radionuclides of the elements Sr, Cs, Rb, I and C in the covering rock of the final store at Gorleben. Project programme II. Final report.** Klotz, D.; Lang, H.; Moser, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie). 1986. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752649/JAW.

The absorption behaviour of the radionuclides was examined in batch and pillar experiments. The objects of the experiments were about 30 non-binding sediments from geological strata between 8 m and 200 m together with natural groundwater or groundwater produced from analytical data with very different salt contents. The dispersivities are in the region of millimetres. In flow pillar experiments, the retardation and re-occurrence rates were determined at filter speeds of about 2x10/sup -4/ cm/sec. The experiments gave a reduction in retardation factors and an increase in reoccurrence rates for cations with an increasing salt content of the groundwater. No specific effects could be found for anions. The adsorption equilibrium coefficients of the binding sediments were higher by about two orders of magnitude, where the absorption process on the binding sediments seemed to be more reversible than those on the non-binding sediments. Parameter variations depend greatly on the equilibrium coefficient of the carrier content of the radionuclide. Selective effects on the absorption values can be caused by organic materials present in the groundwater, e.g. tensides. One can expect only a small effect on the absorption coefficient due to a changed ambient temperature. The results show that the spread of the radionuclides examined depends mainly on the sediment sample examined and the salt content of the associated groundwater. With 26 tabs., 8 figs..

25059 **(IC—86/376) On a computational method for modelling complex ecosystems by superposition procedure.** He Shanyu. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701843/JAW.

In this paper, the Superposition Procedure is concisely described, and a computational method for modelling a complex ecosystem is proposed. With this method, the information contained in acceptable submodels and observed data can be utilized to maximal degree. (author). 1 ref.

25060 **(JAERI-M—87-194) Measurement apparatus of water flow rate in aquifer zone and its performance.** Yamamoto, Tadatoshi; Mukai, Masayuki. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 30p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752345/JAW.

As an apparatus attached to the simulation apparatus for environmental radionuclide migration, a measurement apparatus of water flow rate equipped with a heater and two sensors was made for the measurement of the distribution of water flow rate. In the aquifer zone vessel of 900 mmW x 2700 mmL x 450 mmH, the measurement was carried out by heat pulse method. In the range of water flow rate of 0 - 1.25 mm/min, the measured values in water flow rate had some scatters at 45 measured points. The mean value of the distribution observed was close to the setting value and maximum error of 12 % had been obtained in the measurement. The

sufficient performance as measurement apparatus of water flow rate in aquifer zone was ascertained here.

25061 **(LBL—24344) Mapping surficial radium content as a partial indicator of radon concentrations in US houses.** Revzan, K.L.; Nero, A.V.; Sextro, R.G. (Lawrence Berkeley Lab., CA (USA)). Dec 1987. Contract AC03-76SF00098. 12p. (CONF-871208—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006315/JAW.

From 4. international symposium on the natural radiation environment; Lisbon, Portugal (7 Dec 1987).

In connection with the problem of indoor radon, we discuss the use of a database developed from the National Aerial Radiometric Reconnaissance in the development of a map of radium in soil for the contiguous 48 states. We examine the relationship between the results of measurements of radon in houses and the indications of the US map, noting that some, but by no means all, of the areas known to have elevated radon concentrations appear as areas of higher radium concentration than their surroundings and that there are other areas, in which measurements of high radon levels have not been made, which are suggested as deserving of interest. We discuss mapping techniques for smaller areas and possible methods of dealing with apparent discrepancies between adjacent areas. We show that, on a national basis, as much as half the variation in radon from region to region may be accounted for by the level of radium in the soil, but that there are regions for which the radium concentration does not account for the relatively high observed radon. 3 refs., 3 figs.

25062 **(NIRS-M—65) Radionuclide transfer from contaminated field to crops.** Ohmomo, Yoichiro; Tanaka, Giichiro (eds.). (National Inst. of Radiological Sciences, Chiba (Japan)). Mar 1987. 137p. (In Japanese). (CONF-8512146—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752349/JAW.

From 13. NIRS environmental seminar; Chiba, Japan (5 Dec 1985).

Since the policy for land disposal of radioactive wastes were proposed, the importance of terrestrial radioecology has been rerecognized in Japan. The National Institute of Radiological Sciences (NIRS) held a Two-Day Seminar concerning terrestrial transfer of radionuclides. This is a compilation of papers presented at the seminar. The purpose of the seminar is twofold: firstly, to raise basic problems concerning transfer of not only radionuclides but also elements into crops, as well as to present NIRS's studies on radionuclide transfer; and secondly, to discuss in depth the topics about possible transfer of I-129 into rice plant arising from the commercial fuel reprocessing plant, the construction of which is under planning. Finally, general discussion of further issues on radioecology is given. (Namekawa, K.).

25063 (PNL—6100-Pt.2, pp 15-16) **Environmental behavior of inorganic anions.** Garland, T.R.; Cataldo, D.A.; Fellows, R.J.; Wildung, R.E. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

Recent efforts have addressed two aspects of anion behavior in the soil/plant system. The first involves evaluation of the gaseous component of the terrestrial iodine cycle in soils and plants. Field analyses of ^{129}I in soils and vegetation adjacent to a fuels reprocessing facility, which was idle for 10 years prior to the study, indicated that there may be a significant gaseous component to the terrestrial iodine cycle. Soil substrates, including a silt-sand, organic forest soil, quartz sand, and a sterilized soil, were amended with radioiodide, and the rates and quality of the volatile components evaluated.

25064 **(SKB-TR—86-27) Hydraulic testing in crystalline rock. A comparative study of single-hole test methods.** Almen, K.E.; Andersson, J.E.; Carlsson, L.; Hansson, K.; Larsson, N.A. (Sveriges Geologiska Undersoekning, Uppsala). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Sveriges Geologiska Undersoekning, Uppsala). Dec 1986. 187p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88752712/JAW.

Swedish Geolocical Company (SGAB) conducted and carried out single-hole hydraulic testing in borehole Fi 6 in the Finnsjoen area of central Sweden. The purpose was to make a comprehensive evaluation of different methods applicable in crystalline rocks and to recommend methods for use in current and scheduled investigations in a range of low hydraulic conductivity rocks. A total of eight different methods of testing were compared using the same equipment. This equipment was thoroughly tested as regards the elasticity of the packers and change in volume of the test section. The use of a hydraulically operated down-hole valve enabled all the tests to be conducted. Twelve different 3-m long sections were tested. The hydraulic conductivity calculated ranged from about 5x10/sup -14/ m/s to 1x10/sup -6/ m/s. The methods used were water injection under constant head and then at a constant rate-of-flow, each of which was followed by a pressure fall-off period. Water loss, pressure pulse, slug and drill stem tests were also performed. Interpretation was carried out using standard transient evaluation methods for flow in porous media. The methods used showed themselves to be best suited to specific conductivity ranges. Among the less time-consuming methods, water loss, slug and drill stem tests usually gave somewhat higher hydraulic conductivity values but still comparable to those obtained using the more time-consuming tests. These latter tests, however, provided supplementary information on hydraulic and physical properties and flow conditions, together with hydraulic conductivity values representing a larger volume of rock.

25065 **(SKB-TR—87-05) Applications of stochastic models to solute transport in fractured rocks.** Gelhar, L.W. (Massachusetts Inst. of Tech., Cambridge (USA)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1987. 63p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752713/JAW.

A stochastic theory for flow and solute transport in a single variable aperture fracture bounded by sorbing porous matrix into which solutes may diffuse, is developed using a perturbation approximation and spectral solution techniques which assume local statistical homogeneity. The theory predicts that the effective aperture of the fracture for mean solute displacement will be larger than the aperture required to calculate the large-scale flow resistance of the fracture. This ratio of apertures is a function of the variance of the logarithm of the apertures. The theory also predicts the macrodispersion coefficient for large-scale transport in the fracture. The resulting macrodispersivity is proportional to the variance of the logaperture and to its correlation scale. When variable surface sorption is included, it is found that the macrodispersivity is increased significantly, in some cases more than an order of magnitude. It is also shown that the effective retardation coefficient for the sorptively heterogeneous fracture is found by simply taking the arithmetic mean of the local surface sorption coefficient. Matrix diffusion is also shown to increase the fracture macrodispesivity at very large times. A reexamination of the results of four different field tracer tests in crystalline rock in Sweden and Canada shows aperture ratios and dispersivities that are consistent with the stochastic theory. The variance of the natural logarithm of the aperture is found to be in the range of 3 to 6 and the correlation scales for logaperture ranges from .2 to 1.2 meters. Detailed recommendations for additional field investigations at scales ranging from a few meters up to a kilometer are presented.

25066 **(SKB-TR—87-06) Some properties of a channeling model of fracture flow.** Tsang, Y.W.; Tsang, C.F.; Neretnieks, I. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Engineering). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1986. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752714/JAW.

The Gamma distribution and the log-normal distribution were used to describe the density distribution of the apertures within a channel. For every set of parameter values (correlation length, and the parameters of the distributions) 95 different statistically equivalent channels were generated. The aperture distribution along the channels are then used to determine the total channel volume, the hydraulic conductivity and the flow rate and residence time for a given gradient. The volumes of the channels were found

to vary little whereas the hydraulic conductivity, which is primarily determined by the smallest aperture along the channels, varies considerably. For a wide density distribution the hydraulic conductivity easily spans several orders of magnitude. The flow rate and the velocity variations are primarily influenced by the conductivity variations and are only to a small extent influenced by the volume variations in the channel. The average specific area of the whole channel exhibits small variations. The hydraulic and transport properties of hypothetical fractures containing several channels are investigated by randomly picking several of the generated channels, coupling them in parallel and subjecting them to the same hydraulic head difference. The flow rate and residence time distribution of the coupled channels is used to investigate the dispersion properties of the fracture. It was found that the dispersion expressed as Peclet numbers was on the order of 1 to 4 for most of the distributions used but could attain very large Peclet numbers for (unrealistically) narrow aperture distributions. Simulations of breakthrough curves for tracers in single fracture flow experiments indicate that when few channels participate and the dispersion in the individual channels is small, the breakthrough curve is expected not to be entirely smooth but to contain distinct plateaus. This property has been noted in several experiments.

25067 **(SKB-TR—87-10) Outline of models of water and gas flow through smectite clay buffers.** Pusch, R.; Hoekmark, H.; Boergesson, L. (Sveriges Geologiska Undersoekning, Uppsala). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Sveriges Geologiska Undersoekning, Uppsala). Jun 1987. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752718/JAW.

Microstructure analyses of natural clays with hydrous mica or smectite as major clay mineral have demonstrated that there are large variations in pore size, and that a few wide pores may be responsible for the great majority of the permeation. A similar behavior may be valid also for 'artificially' produced smectite clays which are formed from powdered Na bentonite. A model is derived for such clays in which the powder grains are regarded as anisotropic aggregates which swell on wetting and form a network with pores that are successively filled with a clay gel that emanates from the aggregates. The density and hydraulic conductivity of the gel is a function of the pore size and distribution as well as of the porewater chemistry. Applying the model to three 'reference' clay types of different bulk density, it is shown that realistic data for the hydraulic and gas conductivities as well as for the ratio of the anion and cation diffusion capacities are arrived at. The model is therefore taken as a basis for further development.

25068 **(SKI—86:2) INTRACOIN. Final report levels 2 and 3. Model validation and uncertainty analysis.** (Swedish Nuclear Power Inspectorate, Stockholm). May 1986. 399p. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88752720/JAW.

At level 2 of INTRACOIN the issue of validation was approached by applying various physico-chemical conceptual models and computer codes aimed at describing radionuclide transport in geologic media to field experiments complemented with laboratory data. In the comparison with model calculations two field experiments were chosen, one in a fractured medium and one in a porous medium. From the level 2 exercise one can draw the conclusion that existing codes can reproduce results from field experiments. In summary, there is an obvious need for better and more detailed experiments in the context of validation of models and codes for radionuclide transport.

25069 **(UCRL—96664) A comparison of model predictions and observations of the transfer of ^{137}Cs through the air-pasture-cow-milk pathway.** Ng, Y.C.; Hoffman, F.O. (Lawrence Livermore National Lab., CA (USA); Oak Ridge National Lab., TN (USA)). Dec 1987. Contract W-7405-ENG-48. 17p. (CONF-8710169—2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005675/JAW.

From Workshop on methods for assessing the reliability of environmental transfer models predictions; Athens, Greece (5 Oct 1987).

Environmental measurements reported for selected locations in the United States and Europe following the Chernobyl accident were compared with model predictions of the transfer of ^{137}Cs through the air-pasture-cow-milk pathway. The models evaluated include IAEA Safety Series No. 57, AIRDOS/EPA, NRC Regulatory Guides 1.109 and 1.111, the National Council on Radiation Protection and Measurements (NCRP) screening model, and the PATHWAY dynamic food-chain model. Time integrals of the ^{137}Cs concentrations in air, pasture, and milk were estimated, and the predicted and observed grass/air, milk/air, and milk/grass concentration ratios were compared. Model predictions of the transfer of ^{137}Cs from air to pasture and from pasture to milk tended to exceed observations. Those of PATHWAY were an exception; PATHWAY consistently underpredicted the grass/air and milk/air concentration ratios due to the use of parameter values specific for the deposition of large particles and their interception and retention by vegetation. Some of the models were flexible enough to permit parameter adjustment. In these cases, parameter values could be adjusted to the specific conditions determined for a location, which substantially reduced the discrepancy between predictions and observations. 22 refs., 8 tabs.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 24112, 24165, 24168, 24217, 24300, 25035, 25096

25070 (DOE/CH/10093—6, pp 222) **Impacts of cable yarding systems on soil disturbance and nutrient levels.** Shumway, J.S. (Washington Dept. of Natural Resources, Olympia). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

The objective is to evaluate the changes in soil disturbance and nutrient levels that occur from yarding firewood-sized materials with a small-scale cable yarding system under two different sets of soil moisture conditions and to compare these changes with changes that occur as a result of slashing and burning these wood residues. Eighty temporary plots were installed on three treatment sites to evaluate site index, stocking level, age, tree volumes, and understory vegetation. Approximately 2500 lb of forest floor and soil samples have been collected and analyzed for phosphorus. Disturbance on the yarded units appears to be low; but the large, unanticipated accumulation of slash will make locating the transects during the second measuring operation difficult.

25071 (DOE/CH/10093—6, pp 229) **Environmental impacts of intensive utilization of lodgepole pine for energy.** Little, S.N.; Waddell, D.R. (Forest Service, Portland, OR). Jul 1987. NTIS, PC A16/MF A01. Order Number DE87001140/JAW.

In Biofuels and municipal waste technology research program summary: FY 1986.

Increased demand for lodgepole pile for composite fiber products and fuel in south central Oregon has made whole-tree harvesting of lodgepole attractive. The pumice soils in this area are poor and are known to be deficient in nitrogen (N), phosphorus (P), and sulfur (S). This project will: (1) develop estimates of the amount of N, P, and S in individual trees by component (roots, bole, bark, and crown) and for the soil, understory, and residue found in the lodgepole pine/bitterbrush community; (2) assess the relative value of different tree components to the total site capital of forest stands; and (3) evaluate the ability of these sites to sustain intensive harvest over several rotations in light of the published literature. Field sampling efforts scheduled for the 1986 season were completed. Samples are being prepared for chemical analysis.

25072 **(DOE/EV/00703—T1-Vol.1) The natural history of Enewetak Atoll: Volume 1, The ecosystem: Environments, biotas, and processes.** Devaney, D.M.; Reese, E.S.; Burch, B.L.; Helfrich, P. (eds.). (Hawaii Univ., Honolulu (USA); USDOE Office of Scientific and Technical Information, Oak Ridge, TN). 1987. Contract AC08-76EV00703. 237p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE87006110/JAW.

The two volumes of The Natural History of Enewetak Atoll summarize research done at the Mid-Pacific Research Laboratory from 1954 to 1984 under the auspices of the Department of Energy. The history of the laboratory and the reasons for its support by the United States Department of Energy are described in Chapter 1 of Volume 1. Volume 1 provides a synthesis of the research carried out under the subject headings of the respective chapters. Certain of the chapters, e.g., those on geology, subtidal and intertidal environments and ecology, and those on reef processes and trophic relationships, summarize a great diversity of research carried out by many scientists for many years. In contrast, the chapters on meteorology and oceanography summarize research carried out under one integrated program involving fewer scientists working over a shorter period. Individual chapters are processed separately for the data base.

25073 **(DOE/EV/00703—T1-Vol.2) The natural history of Enewetak Atoll: Volume 2, Biogeography and systematics.** Devaney, D.M.; Reese, E.S.; Burch, B.L.; Helfrich, P. (eds.). (Hawaii Univ., Honolulu (USA); USDOE Office of Scientific and Technical Information, Oak Ridge, TN). 1987. Contract AC08-76EV00703. 346p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE87006111/JAW.

The two volumes of The Natural History of Enewetak Atoll summarize research done at the Mid-Pacific Research Laboratory from 1954 to 1984 under the auspices of the Department of Energy. Volume 2 of The Natural History of Enewetak Atoll provides information on the taxonomy of animals and plants known to occur at Enewetak Atoll. The collections on which the checklists in each chapter are based are housed at the Bernice P. Bishop Museum in Honolulu and the US National Museum of Natural History, Smithsonian Institution, Washington, DC. In addition to the species checklists, each chapter in Volume 2 provides a succinct summary of the biota with respect to endemism, range extensions, and other features that set the Enewetak biota apart from those one might expect to find on equivalent Indo-Pacific islands. This compendium of taxonomic information for an atoll should prove of immense value to scientists interested in biogeography and evolutionary biology of island ecosystems for years to come. Individual chapters are processed separately for the data base.

25074 **(EGG—10282-2185) Distribution, abundance, and habitat use of the endangered blunt-nosed leopard lizard on the Naval Petroleum Reserves, Kern County, California.** Kato, T.T.; Rose, B.R.; O'Farrell, T.P. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). Sep 1987. Contract AC08-83NV10282. 51p. NTIS, PC A04/MFA 01; 1; GPO Dep. Order Number DE88005678/JAW.

The distribution, abundance, and habitat use of the endangered blunt-nosed leopard lizard, Gambelia silus, was studied on and adjacent to Naval Petroleum Reserves No. 1 (NPR-1, Elk Hills), and No. 2 (NPR-2, Buena Vista), Kern County, CAlifornia. A total of 262 blunt-nosed leopard lizards were seen over 8 years (1979-1987) in 28 sections of NPR-1, 15 sections of NPR-2, and 10 sections adjacent to the petroleum reserves. All but one were in areas of gentle or flat relief with sparse annual ground cover. Home range size and overlap, activity patterns, and habitat use were determined from monitoring blunt-nosed leopard lizards fitted with miniature radiocollars on two study sites. Mean home range size estimated by the minimum polygon method was 2.7 acres for female blunt-nosed leopard lizards, which was significantly smaller than the 5.4 acres mean home range size for males inhabiting a major wash. The structure of the habitat affected significantly the lizards' activity and burrow use. Lizards inhabiting the wash study site were more frequently seen on the surface not associated with a burrow than lizards in the more sparsely vegetated grassland study site (63% compared with 48% of their sightings); 51.5% of the sightings for lizards in the grassland study site were associated with burrows, compared with 37.1% for lizards in the wash study site. Burrows were not shared and some burrows were used more than once (30% of burrows and 62% of burrow sightings).

25075 (PNL—6100-Pt.2, pp 9-12) **National Environmental Research Park.** Rickard, W.H. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

The National Environmental Research Park at Hanford serves as an outdoor laboratory. It is a representative segment of the shrub-steppe ecosystem that occupies the semiarid intermountain region of the northwestern US, east of the Cascades and generally west of the Rocky Mountains. For 40 years the 1400-km^2 Hanford Site has been free from the usual kinds of land use widely practiced in the shrub-steppe region. Its use has been partially industrial with a few scattered industrial buildings. Most of the land plays a passive role as a health and security buffer zone. However, the unusually large area assigned to passive land use makes the land attractive for various kinds of basic ecological research both from the view of scientific observations and descriptions as well as experimental manipulations and development of ecological monitoring methodology. The isolation and protection provided by the Hanford Site allows the long-term preservation of control areas. In addition, the large land area allows for experimental manipulation in the absence of customary land use interferences.

5106 Regulations

REFER ALSO TO CITATION(S) 24526, 24527, 25036, 25037

52 ENVIRONMENTAL SCIENCES, AQUATIC

REFER ALSO TO CITATION(S) 25038

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 24101, 24102, 24103, 24525, 24538, 24825, 25048, 25049, 25258

25076 **(CONF-871063—1) The Pacific Basin Consortium for Hazardous Waste Research.** Cirillo, R.R.; Sather, N.F.; Carpenter, R.A.; Smith, K.R. (Argonne National Lab., IL (USA); Environment and Policy Inst., Honolulu, HI (USA)). Oct 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005960/JAW.

From World conference on hazardous waste; Budapest, Hungary (25 Oct 1987).

The Pacific Basin Consortium for Hazardous Waste Research was formed in 1986 to strengthen the capabilities of Pacific Basin countries for managing their mounting problems with hazardous chemical waste. The Consortium curently comprises 29 research laboratories and academic institutions in 13 Pacific Basin countries. During the past year, the Consortium's efforts have focused on planning joint research projects to be undertaken by Consortium members and on a conference on hazardous waste management issues relevant to the Pacific Basin. This paper reviews the available information on these issues and summarizes the activities of the Consortium during its first year. 2 refs., 2 tabs.

25077 **(CONF-8705260—1) Modeling groundwater transport of dissolved gasoline and using the results to evaluate aquifer restoration processes.** Yin, S.C.L.; Chiu, Shen-yann. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006011/JAW.

From Conference on hazardous waste research; Manhattan, KS, USA (20 May 1987).

Solute transport models can be used to simulate aquifer restoration processes for groundwater contaminated by dissolved gasoline. Generic aquifer restoration problems, representing a generalized contamination case for a typical range of aquifer characteristics, were formulated by a selected solute transport model. The results of the simulations were used to evaluate the feasibility and effectiveness of aquifer restoration by pumping out the contaminted water. The aquifer restoration process consists of a single well located at the center of the contaminated area to pump the ground-

water at constant rates of 400, 50, and 5 gpm for three selected aquifer cases, respectively. The pumping rates were selected such that the maximum well drawdown in all three cases is about 10 feet after 20 years of pumping. The modeling results indicate that the time of pumping required to reduce hydrocarbon concentrations down to acceptable levels is quite sensitive to hydraulic conductivity of the aquifer and retardation factors of the hydrocarbons. The aquifer cases considered in the restoration problem had hydraulic conductivities, respectively, of 5000, 500, and 50 gpd/ft^2. Each aquifer was assumed to be unconfined and to be 20 ft thick. The gasoline-contaminated area in each case was assumed to be 100 ft by 200 ft, with a uniform concentration of hydrocarbons. The removal of two hydrocarbons (benzene and xylene) was simulated by the transport model.

25078 **(DOE/ER/60451—2) Production and turnover of suspended organic detritus in the coastal water of the southeastern continental shelf: Progress report, June 1, 1987-May 31, 1988.** Pomeroy, L.R. (Georgia Univ., Athens (USA). Inst. of Ecology). 1 Dec 1987. Contract FG09-86ER60451. 206p. NTIS, PC A10. Order Number DE88005118/JAW.

This project describes specific aspects of microbial processes and related phenomena that influence the fate of particulate organic materials naturally produced on the continental shelf. SPREX is a cooperative study of the spring removal of water from the southeastern continental shelf. Our contribution included studies of respiratory rate of microorganisms, measurement of bacterial biomass and bacterial biomass production and measurement of carbon and nitrogen content of total seston. BIOTRANS is a cooperative study of the cycle of nitrogen and the flux of energy in the coastal water of the Georgia bight. We are measuring bacterial numbers and biomass production and bacterial respiration in the coastal water. Our studies provide us with an estimate of the rate of turnover of organic matter produced on the inner continental shelf. Marked differences occurred in the efficiency of bacterial utilization of dissolved organic matter between the coastal water and the more oceanic water of the middle and outer continental shelf. FLEX is a cooperative study of the removal of coastal water from the shelf as a result of the change from the summer to the fall wind regime in the southeast. We observed movement of water off the shelf north of Cape Canaveral and various biological consequences of this water movement. Our specific tasks included the measurement of microbial respiratory rates and tracing coastal water by means of dissolved lignins. The latter, which are of exclusively terrestrial origin, not only serve as a tracer tag on coastal water but also provide clues to the length of time the water has been in the coastal zone through changes in composition resulting from differential utilization by microorganisms of various components of the lignin molecules. Humates and fulvates were extracted at sea by chromatography. 60 refs., 12 figs., 7 tabs.

25079 **(DOE/PE/16036—T1) Analysis of biomonitoring techniques to supplement effluent guidelines: Final report.** (Energetics, Inc., Columbia, MD (USA)). 18 Nov 1985. Contract AC01-84PE16036. 87p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88005361/JAW.

The purpose of this report is to review EPA's position on biomonitoring strategies, the applicability and limitations of these strategies, and potential alternatives to biomonitoring. Current methods will be reviewed and perceived improvements identified through discussions with state, federal, and industry representatives. The intent of the proposed amendments is to require states to implement progressive programs of toxic pollutant load reduction where BAT is not sufficient to meet state water quality standards and support public health and water quality objective of the Act. This is reflected in a greater dependence upon bioassay and monitoring techniques as a means of determining the quality of waters. Modeling the fate of chemical compounds in the aquatic environment should espouse the concept that hazard assessment requires understanding the relationships between different chemical concentrations that cause adverse effects in aquatic life and environmental exposure. The use of toxicity bioassays in water pollution control studies has become increasingly popular as an approach to assessing water quality. 50 refs., 4 figs., 4 tabs.

25080 **(EC/Y/CP—7640/3) Hydrocarbons in the Mackenzie River.** Nagy, E.; Carey, J.H.; Hart, J.H.; Ongley, E.D. (Environment Canada, Yellowknife, Northwest Territories. Conservation and Protection). 1987. 34p. NOGAP Secretariat, Constitutional Development and Strategic Planning Branch, Indian and Northern Affairs Canada, Les Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H4; $N/C.

Impaired fish liver quality has been reported on the lower Mackenzie River. This survey was part of a broader study of the possible impact on water quality by the Norman Wells area. A June, 1986 survey along the river found higher alkane and polyaromatic hydrocarbon (PAH) concentrations in the system than a similar survey in August 1985. The concentration distributions along the river suggested diffuse inputs of these organics by the spring runoff from the river's drainage basin, which overwhelmed any inputs from the refinery or from the oil seeps. The distribution of the organics between the suspended sediments and the water phase show the need for analyzing both phases for estimates of organic loadings in the river.

25081 **(EC/Y/CP—CP(EP)-9) Distribution of metals and hydrocarbons in the nearshore zone of the southern Beaufort Sea.** Mudroch, P. (Environment Canada, Yellowknife, Northwest Territories. Conservation and Protection). Mar 1987. 101p. (MICROLOG—87-05095). NOGAP Secretariat, Constitutional Development and Strategic Planning Branch, Indian and Northern Affairs Canada, Les Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A survey of metals and hydrocarbons in bottom sediments was carried out in the Southern Beaufort Sea. Forty three stations were sampled in the area between Herschel Island (Yukon) and Russell Inlet (N.W.T.). All samples were analyzed for Cr, Fe, Ni, Cu, Ba, Zn, Cd, Hg, Pb, particle size, alkanes, and polycyclic aromatic hydrocarbons. Data were statistically analyzed in order to assess the differences in metal and hydrocarbon concentrations between the areas located to the east and west of the Mackenzie River Delta. The results indicated that four metals (Ba, Ni, Zn and Cd) were significantly higher at stations located to the east of the Mackenzie River Delta. Iron was significantly higher in the 15-20 cm core section in samples collected in the Herschel Basin (west of the Mackenzie River Delta) than in any other area. Terrigenous detrital material originating in vascular plant waxes is presumed to be the source of the alkanes found by the survey. The possible sources of the polycyclic aromatic hydrocarbons in this area are petroleum, combustion of fossil fuels, forest fires, and aromatization of naturally occurring precursors. It is recommended that a site specific study be undertaken to quantify the natural variability in the distribution of metals in the Nearshore Zone of the southern Beaufort Sea. It is also recommended that a study be undertaken to distinguish and quantify natural and anthropogenic sources of polycyclic aromatic hydrocarbons. 10 figs., 10 tabs.

25082 (PNL—6100-Pt.2, pp 29-31) **Marine chemistry of energy-related contaminants.** Crecelius, E.A.; Young, J.S. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

PNL has quantified the concentrations and sources of soluble and particulate metals in Puget Sound waters. This information serves as the foundation for other studies that will identify the geochemical processes controlling the concentrations and biological availability of metals to aquatic organisms. Results of the research will be used to determine the upper limits of contaminant exposure that organisms and ecosystems can safely tolerate. This information can be used in monitoring such activities as ocean dumping, harbor dredging, and industrial discharges.

25083 **(UBA-FB—86-045) Investigation on the cleansing capacity of underground material during direct and indirect input of toxic heavy metals.** Kaes-Hoppe, H. (Umweltbundesamt, Berlin (Germany, F.R.)). 1987. 194p. (In German). Umweltbundesamt, Berlin (Germany, F.R.).

Umweltbundesamt - Texte.; no. 4/87.

In various pilot-plants the behaviour of Cd, Cu and Ni had been tested during undergound passage through gravel (Ruhr Valley) with indirect input and slow sand filtration (direct input) with different combinations of grown. The determined high cleansing capacities of both systems were even constant during natural changes of the border factors like composition of the raw water, rain or climate effect. Additional longtime lowering of pH (down to pH 3,5) during underground passage induced only mobilization effects of 10% in maximum. With 31 refs., 41 tabs., 271 figs.

25084 **Large scale comparison of factors influencing phytoplankton abundance in rivers, lakes, and impoundments.** Soeballe, D.M.; Kimmel, B.L. (Oak Ridge National Lab., TN). *Ecology;* 68: No. 6, 1943-1954(Dec 1987). Contract AC05-84OR21400.

The authors analyzed two large data sets (the National Stream Water Quality Accounting Network and the National Eutrophication Survey) to compare quantitatively the ecological structure and function of rivers, river impoundments, and natural lakes on a broad scale. Discriminant analysis with physical-chemical variables separated these three types of aquatic systems along a composite gradient that correlated with water residence time ($r = 0.7$), drainage area ($r = 0.7$), water depth ($r = 0.6$), stream flow ($r = 0.6$), and water clarity ($r = -0.4$). Natural lakes and rivers occupied opposite ends of this gradient, and reservoirs, on average, were intermediate, but natural lakes and impoundments overlapped extensively and did not form a useful dichotomy. Regression analysis showed algal abundance per unit phosphorus increasing in the sequence: rivers < impoundments < natural lakes, which paralleled intergroup differences in residence time. Algal abundance per unit phosphorus did not differ significantly among these three system types when systems with similar residence times were compared. Their results indicate that water residence time is a useful system-level index that has similar ecological implications for rivers, lakes, and reservoirs.

25085 **Atmospheric inputs and the dynamics of trace elements in Lake Michigan.** Tisue, T.; Fingleton, D. (Center for Great Lakes Studies, Univ. of Wisconsin-Milwaukee, Milwaukee, WI 53201 (USA)). pp 105-126 of Toxic contaminants in the Great Lakes. Nriagu, J.O.; Simmons, M.S. New York, NY; John Wiley and Sons Inc. (1984).

It is commonplace to assert that materials deposited from the atmosphere contribute significantly to the flux of minor and trace elements through various compartments of the biosphere. Direct experimental determinations of the atmosphere's contribution to large water bodies are rare. The available evidence suggests that atmospheric deposition of trace elements into large lakes is an important, if not the principle, source for some elements. It can be argued therefore that changing concentrations of these elements in the atmosphere may alter significantly their overall mass budgets in large water bodies, affect long-term trends in their concentrations in the water column, and influence the magnitude and timing of their seasonal concentration cycles. The purpose of this paper is to explore the extent to which these effects are observable in Lake Michigan.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 24069, 24138, 24179, 24731, 24848, 25060, 25064, 25066, 25067, 25248

25086 **(AERE-TP—1207) Coupled groundwater flow and solute transport with fluid density strongly dependent upon concentration.** Herbert, A.W.; Jackson, C.P.; Lever, D.A. (UKAEA Harwell Lab. Theoretical Physics Div.; Department of the Environment, London (UK)). Aug 1987. 46p. (DOE-RW—87.057). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752764/JAW.

The governing equations are discussed for the flow of salt solution with significant density variations through a porous medium. Equations for mass conservation, salt conservation and momentum conservation are formulated in terms of the mass-fraction weighted average velocity and the mass fraction of concentrated salt solution, and the underlying approximations are considered. These equations are incorporated in the finite-element groundwater code NAMMU and applied to test case 5 of Level 1 of the international HYDROCOIN project. This test case proposed to model the groundwater flow over a hypothetical salt dome. The non-linearities arising from the density variation and from a velocity-dependent dispersion tensor made the problem very hard: we had to use special techniques including mixed-interpolation finite elements and parameter stepping. Starting from a related problem involving a large diffusivity we obtained a series of solutions at successively smaller values of dispersion. Our final solution is to a physically realistic problem very similar to that specified. We draw general conclusions relevant to modelling these flows, and have built confidence in our numerical code.

25087 **(CEA-DPS—87-03) Design of the French ocean general circulation model for the assessment of radionuclides dispersion in the North Atlantic.** Chartier, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). Oct 1987. 90p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88752187/JAW.

A three-dimensional finite-difference ocean general circulation model has been developed and adapted to the radionuclides dispersion concerns. The model is briefly described. A sensitivity analysis of the model to key numerical schemes has been performed to optimize the mathematical resolution of the equations. A series of tests have been more specifically achieved on different numerical schemes for the calculation of the vertical velocity. The results are thoroughly analysed.

25088 **(CONF-870627—1) Determination of thorium in seawater by neutron activation analysis and mass spectrometry.** Huh, Chih-An. (Oregon State Univ., Corvallis (USA). Coll. of Oceanography). 1987. Contract FG05-85ER60340. 8p. NTIS, PC A02. Order Number DE88006193/JAW.

From International symposium on radioactivity and oceanography; Cherbourg, France (2 Jun 1987).

The recent development of neutron activation analysis and mass spectrometric methods for the determination of ^{232}Th in seawater has made possible rapid sampling and analysis of this long-lived, non-radiogenic thorium isotope on small-volume samples. The marine geochemical utility of ^{232}Th, whose concentration in seawater is extremely low, warrants the development of these sensitive techniques. The analytical methods and some results are presented and discussed in this article. 24 refs., 3 figs.

25089 **(IC—87/122) On the contamination of two dimensional confined aquifers by pollutants.** Bestman, A.R. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701865/JAW.

The contamination of an aquifer by crude oil is modelled as a two dimensional two phase moving boundary problem for the immiscible water and oil. The solution methodology entails the front tracking method followed by a finite element/finite difference discretization. The resultant equations constitute a system of first order nonlinear coupled ordinary differential equations with initial conditions, and this system is tackled by the classical Runge-Kutta method. The motion of the pollutant front is discussed quantitatively. (author). 3 refs, 2 figs.

25090 **(NUREG/CR—5047) Radionuclide accumulation by aquatic biota exposed to contaminated water in artificial ecosystems before and after its passage through the ground.** Cushing, C.E.; Rickard, W.H.; Watson, D.G. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 23p. (PNL—5590). NTIS, PC A03/MF A01 - GPO. Order Number TI88005664/JAW.

This study was designed to investigate the comparative accumulation of radionuclides from contaminated water in artificial ecosystems before and after the water's passage through the

ground. Fish, clams, algae, and an emergent vascular plant were experimentally exposed to mixtures of radionuclides in three aqueous streams. Two streams consisted of industrial water discharged directly into a leaching trench, and the same water after it had migrated through the ground for a distance of 260 meters. The third stream was river water, which served as a background or control. Biota exposed to river water in the control stream had very low concentrations of ^{60}Co, less than 3 pCi per gram dry weight (pCi/g DW). Other radionuclides were essentially unmeasurable. Biota exposed to trench water accumulated very high relative concentrations of ^{60}Co. Biota exposed to trench water also had measurable concentrations of ^{155}Eu, ^{144}Ce, ^{141}Ce, ^{125}Sb, ^{124}Sb, ^{103}Ru, ^{106}Ru, ^{137}Cs, ^{95}Zr, ^{95}Nb, ^{58}Co, ^{54}Mn, ^{59}Fe, ^{65}Zn, ^{90}Sr, /sup 239,240/Pu, and ^{238}Pu. Biota exposed to ground water had concentrations of ^{60}Co that ranged between 50 and 1200 pCi/g DW. Fish flesh had the lowest concentration of ^{60}Co and algae the highest. Strontium-90 was measured in the tissues of aquatic biota at concentrations ranging between 360 pCi/g DW in clam flesh to 3400 pCi/g DW in leaves and stems of Veronica. Leaves and fruits of tomato plants rooted in the ground water accumulated ^{90}Sr at concentrations of 160 pCi in fruits and 4200 pCi in leaves. Data indicate that ^{60}Co and ^{90}Sr migrated through the ground along with ground-water flow and were available to all classes of aquatic biota and tomato plants rooted in the water via root uptake, sorption, and food chain transfers. 8 refs., 4 figs., 6 tabs.

25091 (PNL-SA—15345) Natural radionuclides in Hanford site ground waters. Smith, M.R.; Laul, J.C.; Johnson, V.G. (Pacific Northwest Lab., Richland, WA (USA); Westinghouse Hanford Co., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 10p. (CONF-871124—60). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005123/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Uranium, Th, Ra, Rn, Pb and Po radionuclide concentrations in ground waters from the Hanford Site indicate that U, Th, and Ra are highly sorbed. Relative to Rn, these radionuclides are low by factors of 10^{-3} to 10^{-6}. Uranium sorption is likely due to its reduction from the +6 state, where it is introduced via surface waters, to the +4 state found in the confined aquifers. The distribution of radionuclides is very similar in all of the confined aquifers and significantly different from the distribution observed in the unconfined and surface waters. Barium correlates well with Ra over three orders of magnitude, indicating that stable element analogs may be useful for inferring the behavior of radioactive waste radionuclides in this candidate geologic repository. 8 refs., 7 figs., 1 tab.

25092 (SKB-TR—87-07) Deep groundwater chemistry. Wikberg, P.; Axelsen, K.; Fredlund, F. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Inorganic Chemistry). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Jun 1987. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752715/JAW.

Starting in 1977 and up till now a number of places in Sweden have been investigated in order to collect the necessary geological, hydrogeological and chemical data needed for safety analyses of repositories in deep bedrock systems. Only crystalline rock is considered and in many cases this has been gneisses of sedimentary origin but granites and gabbros are also represented. Core drilled holes have been made at nine sites. Up to 15 holes may be core drilled at one site, the deepest down to 1000 m. In addition to this a number of boreholes are percussion drilled at each site to depths of about 100 m. When possible drilling water is taken from percussion drilled holes. The first objective is to survey the hydraulic conditions. Core drilled boreholes and sections selected for sampling of deep groundwater are summarized.

25093 (SKB-TR—87-12) Study of groundwater colloids and their ability to transport radionuclides. Tjus, K.; Wikberg, P. (Institute for Surface Chemistry, Stockholm (Sweden); Royal Inst. of Tech., Stockholm (Sweden). Dept. of Inorganic Chemistry). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Mar 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752719/JAW.

Natural occurring colloids in groundwater can adsorb and transport released radionuclides. In this work groundwater colloids have been investigated with zeta potential measurements and dynamic light scattering. The goal was i) to estimate the detection limits of the Institute's equipment for particle size estimation with dynamic light scattering and zeta potential with dynamic light scattering combined with estimation of Doppler shift in the scattered light frequency; ii) to examine several different groundwaters (Stripa, Kamlunge, Svartboberget). The possibility to apply a theoretical adsorption model for interpreting the results is also discussed.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 24069, 24112, 25035, 25072, 25073, 25259, 25260, 25261

25094 (CONF-8711156—1) A non-traditional methodology for flood stage-damage calculations. Das, S.; Lee, R. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005855/JAW.

From 23. American Water Resources Association annual conference; Salt Lake City, UT, USA (1 Nov 1987).

This paper presents a new methodology to calculate economic losses from hypothetical, extreme flood events, such as the Probable Maximum Flood. The methodology uses economic data compiled from already-available secondary sources, such as US Census data on magnetic tapes, utilizing microcomputer and other electronic media. Estimates of land elevations are obtained from topographic maps, and flood elevations are estimated using the dam breach and flood routing (DAMBRK) model. The calculations are performed at a disaggregate spatial scale by various land use and industrial classification categories. The basic areal units are city blocks for urbanized areas, enumeration districts, and Census tracts. Depth-damage functions, which provide an estimate of damages as a proportion of the existing value of the structure, are estimated statistically. Computer software called DAMAGE is used to combine the economic, flood elevation, and depth-damage information to compute economic losses for different possible flood stages and for different inflow events. Two case studies are presented as illustrations of the method. 19 refs., 7 figs., 1 tab.

25095 (DOE/ER/60340—3) DOE West Coast Basin program, California Basin Study: Progress report 4, [July 1986-June 1987]. Small, L.F.; Huh, Chih-An. (Oregon State Univ., Corvallis (USA). School of Oceanography). Jun 1987. Contract FG05-85ER60340. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88005806/JAW.

The overall objective of our research is to understand the transport pathways and mass balances of selected metabolically active and inactive chemical species in the Santa Monica/San Pedro Basins. One focus is to examine the role of zooplankton and micronekton in the cycling and remineralization of chemical materials in the Southern California Bight, with particular reference to C, N and certain radionuclides and trace metals. A second focus is to examine these same radionuclides and trace metals in other reservoirs besides the zooplankton (i.e., in seawater, sediment trap material and bottom sediments). Knowledge of the rates, routes and reservoirs of these nuclides and metals should lead to a cogent model for these elements in Santa Monica/San Pedro Basins. 28 refs., 13 figs., 7 tabs.

5206 Regulations

REFER ALSO TO CITATION(S) 24526, 24527, 25036, 25037

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 24594

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 24518, 24519, 24520, 24521, 24522, 24523, 24524, 25022

25096 **(IRPP—87) Resource rents and public policy in western Canada.** Gunton, T.; Richards, J. (eds.). (Institute for Research on Public Policy, Halifax, Nova Scotia (Canada)). 1987. 306p. (MICROLOG—87-06119). Institute for Research on Public Policy, P.O.Box 3670, Halifax, N.S., Canada B3J 3K6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report suggests that by pursuit of some aggressive reforms, Western Canadians, as owners of resources held by the crown, could receive substantially more economic value from the resource sector than they do now. In general, the argument is organized around three themes: maximization of resource rents, distribution of these rents, and political markets (the underlying political economy that influences how rent collection activity is organized).

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 24526, 24527

25097 **(BES—8703) Norman Wells Research and Monitoring Program. Fourth annual summary report.** (Boreal Ecology Services Ltd., Yellowknife, Northwest Territories (Canada)). Mar 1987. 184p. (MICROLOG—87-06087). Environmental Protection Directorate, Environment Canada, 351 St. Joseph Blvd., Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In August of 1982, the Deputy Minister of the Government of the Northwest Territories Department of Renewable Resources proposed the development and implementation of an intergovernmental research and monitoring program for the oilfield expansion and pipeline projects. The purpose of this program was to test the validity of impact predictions identified during the environmental assessment and review process, and to test the effectiveness of mitigative measures indentified during the regulatory process. The initial task of the Work Group was to identify all environmental issues and concerns related to northern pipelines and oilfield developments. Preliminary field reconnaissance for most projects was carried out during the summer of 1983, and the majority of research and monitoring was well underway by the time pipeline construction began in January 1984. In March of 1987, six years following the Environmental Assessment and Review Panel report, the construction period is over and the oilfield and pipeline facilities have been operating and monitored for two years.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

REFER ALSO TO CITATION(S) 25264, 25265

5502 Biochemistry

REFER ALSO TO CITATION(S) 24229, 24324, 24326, 24840, 25123, 25125, 25127, 25155, 25156, 25158, 25189

25098 **(CONF-871258—1) Guidelines for field testing and environmental use of genetically altered organisms.** Sharples, F.E. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005182/JAW.

From 3. meeting of the UNIDO/WHO/UNEP working group on biotechnology safety; Paris, France (15 Dec 1987).

The environmental applications of biotechnology offer great potential benefits, particularly in agriculture and as a means of replacing chemicals that themselves produce environmental degradation, but there are a number of uncertainties about the risks entailed in the use of such products. These uncertainties arise principally because of gaps in the knowledge bases for basic ecology, microbial biology and ecology, genetics, and risk assessment. The nature of these gaps will be covered briefly in the body of this paper. The need to ensure that the benefits of biotechnology products are safely realized and that their environmental applications do not result in new sources of environmental degradation provides the fundamental rationale for systematic assessments of risk before field testing or commercial use.

25099 **(DOE/ER/13461—1) Active and passive calcium transport systems in plant cells: Progress report, January 1986-September 1986.** Sze, H. (Maryland Univ., College Park (USA). Dept. of Botany). Oct 1986. Contract FG05-86ER13461. 9p. NTIS, PC A02. Order Number DE88006532/JAW.

Two types of ATP-dependent Ca transport systems have been identified in isolated membrane vesicles from oat roots. The properties of the Ca pumps have been partially characterized and the membrane identity has been established. One pump predominantly on the ER is a Ca-pumping ATPase, and the other is a Ca/H antiport system dependent on the electrochemical gradient from the tonoplast-type H-ATPase. Though the two systems differe in several respects, they may both be important for regulating cytoplasmic [Ca] by removing Ca from the cytoplasm. We have also examined how a fungal toxin (Helminthosporium maydis T) might alter membrane functions. The HmT toxin decreased active Ca transport into mitochondria from susceptible corn by increasing membrane permeability to Ca and H^+. We found that the toxin alone increased conductance of planar bilayer membranes to cations. The dependence of Ca fluxes on the pH gradient and membrane potential or both, stresses the need to understand the mode of toxin action on membrane functions in general. 5 figs., 3 tabs.

25100 **(DOE/ER/13496—3) The structure of pectins and their possible role in resistance of cotton to cotton blight: Progress report.** (Oklahoma State Univ., Stillwater (USA)). 1988. Contract FG05-86ER13496. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006535/JAW.

We have characterized the disaccharide repeating unit of the backbone of rhamnogalacturonan I (RG I). In the intact cell wall the disaccharide is polymerized by α 1-4 linkages from the rhamnose to a galacturonic acid.

25101 (LBL—22300, pp 181-184) **Large high density lipoproteins: Their apolipoprotein specificity and origins.** Gong, E.L.; Nichols, A.V.; Forte, T.M.; Blanche, P.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The high density lipoproteins (HDL) are characterized by their unique apolipoprotein content (apolipoprotein AI [apo/AI] and apolipoprotein AII [apo/AII] and density upon ultracentrifugal

isolation. Ultracentrifugal analysis of total HDL shows two major subclasses of HDL, namely HDL_2 (mean hydrated density 1.090 g/ml) and HDL_3 (mean hydrated density 1.145 g/ml). Ultracentrifugal methods of analysis have also shown a significant difference in the HDL profiles between normal human males and females. The average male HDL profile shows a predominance of smaller more dense particles that form the HDL_3 subclass, while the average female profile exhibits a greater content of larger less dense particles that comprise the HDL_2 subclass. 5 refs., 5 figs.

25102 (LBL—22300, pp 185-187) **Lipoprotein complex formation.** Musliner, T.A.; Krauss, R.M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Transfers of lipids and proteins between different lipoproteins are known to occur in the course of their metabolism. It is likely that these transfers take place during transient physical associations between lipoprotein particles, but the nature and chemical basis for such interactions are poorly understood. The fact that lipid and apolipoprotein movements are particularly prevalent during the intravascular lipolysis of triglyceride-rich lipoproteins suggested to us that lipolysis products accumulating on these particles might promote physical binding with other lipoproteins. To test this hypothesis, we studied interactions between very low-density, low density, and high-density lipoproteins in the setting of partial lipolysis by bovine milk lipoprotein lipase in the presence of limited unesterified fatty acid acceptor. 2 figs., 1 tab.

25103 (LBL—22300, pp 192-194) **Characterization of high density lipoprotein subclasses isolated from the human hepatoma derived cell line, Hep G2.** McCall, M.R.; Forte, T.M.; Shore, V.G. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The study of lipoprotein synthesis and catabolism is complicated by the dynamic nature of these processes. Nascent lipoproteins from hepatic or intestinal synthetic sites undergo a variety of extremely rapid enzymatic and exchange processes when released into the extracellular milieu. Interstitial fluid, lymph, or plasma lipoproteins may therefore not be very representative of lipoproteins as released from the cell. Intracellular lipoproteins, although visible with an electron microscope, are difficult to isolate for study due to their close association with cellular membranes.

25104 (LBL—22300, pp 195-196) **Caco-2 cells: A human intestinal cell line with the capacity for secreting lipoproteins.** Forte, T.M.; Hughes, T.E.; Sasok, W.V.; Ordovas, J.M.; Lamon-Fava, S.; Schaefer, E.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We have sought to determine whether the Caco-2 cells might be a reasonable model in which to study lipoprotein synthesis and regulation. To identify lipoproteins, Caco-2 cells were grown to confluency in DMEM plus fetal bovine serum (FBS) at which time FBS was removed and cells were grown in serum-free defined medium. In some experiments, ^{35}S-methionine was included in the medium to look for de novo synthesis of apolipoprotein and distribution of label in lipoprotein classes. Lipoprotein fractions were also examined by electron microscopy to determine whether identifiable structures were secreted by the cells.

25105 (LBL—22300, pp 203-204) **The molecular design of membrane channels.** Jap, B.K. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

PhoE porin is a member of a family of related pore-forming proteins found in the outer membrane of Escherichia coli. It is expressed under growth conditions involving phosphate-starvation. We have reconstituted purified PhoE with phospholipids, forming two-dimensional crystals. The unit cell dimensions of the crystal are a = 150 A and b = 130 A. There are four trimers of PhoE in a rectangular unit cell. The crystals diffract to a resolution better than 6 A. This is the first case that a membrane protein, which does not naturally form two-dimensional crystalline arrays, has been reconstituted to form crystalline patches giving high resolution diffraction information. We have also obtained the three-dimensional reconstruction of PhoE porin negatively stained with uranyl acetate. The three-dimensional map was obtained from images having tilt angles ranging +- 60°. The resolution of our map is currently limited to ~20 A. The map shows that trimeric stain-filled channels form a basic unit. 2 figs.

25106 (LBL—22300, pp 209-211) **Circular differential scattering and circular differential absorption of DNA protein condensates and of dyes bound to DNA protein condensates.** Phillips, C.L.; Mickols, W.; Maestre, M.F.; Tinoco, I. Jr. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

One spectroscopically well defined form of condensed DNA is the Psi form. Psi condensates are characterized by very large circular dichroism (CD) extinction coefficients. Light scattering is an important part of the total absorption spectrum of Psi condensates and is also an important contribution of the CD. CD depends both on circular differential absorption and circular differential scattering. Several experimental methods have been developed to correct for circular differential scattering in CD spectra in order to see primarily circular differential absorption. The scatter-corrected CD spectra of Psi DNA condensates do not like classic uncondensed DNA CD spectra. The conditions to produce Psi-type spectra include nonaqueous solvents, high salt concentration, the presence of polymers, and gelation into fibers. Small changes in preparation cause large changes in the spectra. The results also imply that a Psi preparation is a continuum of closely related structures. 6 refs., 1 fig.

25107 (LBL—22300, pp 217-220) **The CRO-1 gene of Saccharomyces cerevisiae controls mitotic crossing over, chromosomal stability and sporulation.** Esposito, M.S.; Maleas, D.T.; Bjornstad, K.A.; Holbrook, L.L. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The properties of a novel temperature-sensitive recombination-defective mutant of Saccharomyces cerevisiae, cro1-1 is described. The cro1-1 mutant is the first instance of a rec mutation that reduces drastically the rates of spontaneous mitotic crossing-over events but not those of gene conversional events. The cro1-1 mutation thus provides evidence that mitotic crossing-over is dependent upon gene products that are not essential for gene conversional events. The cro1-1 mutation also results in enhanced mitotic-chromosomal instability and MATa/MATα cro1-1/cro1-1 mutants are sporulation deficient. These phenotypes indicate that the CRO1 gene modulates mitotic chromosomal integrity and is essential for normal meiosis. The cro1-1 mutant possesses Holliday junction resolvase activity, hence its recombinational defect does not involve failure to execute this putative final recombinational step. 7 refs., 1 fig., 5 tabs.

25108 (LBL—22300, pp 220-224) **Partial purification of Holliday junction resolvase activity from Saccharomyces cerevisiae.** Holbrook, L.L.; Bjornstad, K.A.; Maleas, D.T.; Esposito, M.S. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Toward the goal of understanding genetic recombination on a molecular level, we are focusing on the essential final step, resolution of the Holliday junction intermediate. This report describes progress in the purification and characterization of this activity from the yeast Saccharomyces cerevisiae. Resolvase activity is assayed by conversion of cruciform-containing supercoiled pBR322 dimer DNA or cruciform-containing supercoiled ColE1 DNA to linear forms by cleavage at the base of the cruciform. Resolvase activity, which can be detected in cell-free extracts prepared from haploid and diploid mitotic cells, is dependent on the presence of magnesium, is independent of ATP, and the reaction is inhabited by concentrations of sodium or potassium chloride of 100 mM or greater. Linear DNA is not a substrate for this activity. 6 refs., 8 figs.

25109 (LBL—22300, pp 225-227) **Single strand specific DNA binding proteins of Saccharomyces cerevisiae.** Hosoda, J.; Bell, M.; Bjornstad, K.A.; Hosobuchi, M.M.; Moise, H.W.; Esposito, M.S. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We previously described the purification of a single-strand specific-DNA-binding protein, SSB-1, from mitotic cells of a protease-deficient mutant of Saccharomyces cerevisiae. To elucidate the physiological significance of SSB-1 known to be associated with prokaryotic SSB proteins, E. coli SSB and T4 gp32 were surveyed including destabilization of poly[d(A-T)] and DNA renaturation. Proteins with strong selective affinity for single stranded (ss) DNA and have inherent capacity to destabilize the dobule-stranded helix to single-stranded coil-melting transition. Thus they are called helix-destabilizing proteins (HDP), DNA melting proteins or DNA unwinding proteins (UP). Upon binding to ssDNA, HDP melts intrastrand hairpin helices and holds the DNA strand in conformation in which bases are exposed to the outside of the complex. In the case of T4 gp32, the disruption of the hairpins on the template strands is known to be one of the mechanisms by which it facilitates DNA synthesis by the homologous DNA polymerase. 3 refs., 5 figs.

25110 (LBL—22300, pp 229-231) **Molecular analyses of yeast recombination-repair genes.** Mortimer, R.K.; Schild, D.; Aker, M.; Cole, G.; Game, J.; Lovett, S.; Sitney, K. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Genes in the recombinational repair pathway in the yeast Saccharomyces cerevisiae confer resistance to x-ray irradiation. Mutations in these genes disrupt the repair of double-stranded DNA breaks with multiple phenotypic effects such as abnormalities in meiosis and recombination. This epistasis group includes the genes RAD50 to RAD57. As discussed in previous annual reports, we have cloned many of these genes and are using the clones for molecular analyses of these genes. During the past year we have continued these studies, with particular emphasis on the transcriptional regulation of RAD51, RAD52 and RAD54, and the sequencing of RAD51. In addition we have initiated molecular research on RAD24, a gene involved in several DNA repair pathways in yeast. 7 refs., 1 fig.

25111 (LBL—22300, pp 231-234) **Induced excision repair is required for repair of lesions in the vicinity of DNA replication forks.** Copper, P.K.; Gee, S.; Ling, V. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

A technique for resolving DNA fragments containing replication forks from linear DNA fragments by two-dimensional agarose gel electrophoresis is described. The technique is based on the altered mobility in agarose of branched structures relative to linear double-stranded molecules as a function of gel concentration and voltage. When pulse-labeled DNA is isolated, purified, fragmented by digestion with restriction nucleases, and run in the two-dimensional gel system, the bulk of the DNA migrates in a single arc visible by staining with ethidium bromide. However, when autoradiograms are prepared from the gels, it can be seen that the nascent DNA, represented by the radioactive pulse label, is contained in a second distinct arc. We have shown by a variety of criteria that the nascent DNA migrating in this minor arc has properties consistent with replication fork structures. We have now applied this technique to testing the hypothesis that long patch repair occurs at lesions in the vicinity of DNA replication forks. 2 figs.

25112 (LBL—22300, pp 234-236) **Repair of DNA damage in the human metallothionein gene family.** Leadon, S.A.; Snowden, M.M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

In order to distinguish enhanced repair of a sequence due to its transcriptional activity from enhanced repair due to chromatin alterations brought about by integration of a sequence into the genome, we have investigated the repair of damage both in endogenous genes and in cell lines that contain an integrated gene with an inducible promoter. The endogenous genes we are studying are the metallothioneins (MTs), a multigene family in man consisting of about 10-12 members. Cultured cells were exposed to 10-J/m^2 uv light and allowed to repair in the presence of bromodeoxyuridine. The DNA was then isolated, digested with Eco RI, and fully hybrid density DNA made by semiconservative synthesis was separated from unreplicated DNA by centrifugation in CsCl density gradients. Unreplicated, parental-density DNA was then reacted with a monoclonal antibody against bromouracil. 1 ref., 1 fig., 1 tab.

25113 (LBL—22300, pp 237-238) **Alkylation of polynucleotides in vitro and in vivo.** Singer, B.A.; Spengler, S.J.; Chavez, F.; Fraenkel-Conrat, H.; Kusmierek, J.T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

O^4-alkyl thymine DNA adducts have been implicated as causative lesions in chemical mutagenesis and carcinogenesis induced by N-nitrosamine and N-nitrosourea. The kinetics of incorporation of O^4-alkyl dTTPs as analogues of dTTP indicate that they recognized by a variety of polymerases but, in their presence, synthesis from synthetic polymers or DNA templates terminates within a short time. Our interpretation of the termination of synthesis is that the primer end with O^4-alkyl dT did not form hydrogen bonds of sufficient stability to permit utilization of the 3′-OH by polymerases, as contrasted to possible proofreading activity or idling. To discriminate between these explanations, we studied the ability of the $3' \rightarrow 5'$ exonuclease activities of E. coli DNA polymerase I (Pol I) and the T_4 DNA polymerase, both known to degrade poly d(A-T) in the absence of dNTPs, to digest a similar polymer containing O^4-methyl dT (m^4T) as well as dT. Contrary to expectation, the polymers containing m^4T were completely resistant to the $3' \rightarrow 5'$ exonuclease activity of the two polymerases. 4 refs., 2 figs.

25114 (LBL—22300, pp 238-241) **Effects of alkylating carcinogens on human tumor cells in culture.** Goth-Goldstein, R.; Hughes, M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

In Escherichia coli 3-methyladenine and 3-methylguanine have been identified as lethal lesions, since two types of alkylating agent-sensitive mutants were deficient in repair of either of these lesions. Similar alkylation-sensitive human cell lines exist. These are the tumor cell lines of the complex Mer^- phenotype. All Mer^- cells examined were hypersensitive to killing by MNNG and other alkylating agents, and failed to repair O^6-methylguanine. The widely studied HeLa S3 cell line has the Mer^+ phenotype, but a Mer^- variant (HeLa MR) has arisen. This offers the possibility to study Mer^- and Mer^+ cells of otherwise similar genetic background. We are using these two variants to analyze the Mer^- phenotype further. When HeLa S3 and HeLa MR were treated with a highly dose of MNNG, and the surviving population exposed to a second dose of MNNG 2-3 weeks later, HeLa S3 (Mer^+) cells were equally or even slightly more sensitive to a second exposure of MNNG, whereas the surviving HeLa MR (Mer^-) population was much more resistant to MNNG. 1 fig., 1 tab.

25115 (LBL—22300, pp 259-261) **Specialized membrane biogenesis in mammary epithelial cells.** Parry, G.; Cullen, B.L.; Moss, L. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The apical membrane of the mammary gland epithelial cell is highly differentiated and adapted to participate in the process of fat secretion. Certain of the apical membrane differentiation antigens are frequently expressed on membrane carcinoma cells, and knowledge of the normal mechanisms by which these antigens are regulated may have implications for a better understanding of tumor antigen expression. Because the apical membrane of the cell is lost during secretion, active membrane biosynthesis must accompany fat secretion, and the cell represents a good model for studying membrane biogenesis in polarized epithelial cells. Experiments have been carried out using primary cultures of cells established from mammary glands of late pregnant mice and also a mouse cell line, COMMA-1-D, that differentiates in an appropriate milieu. When fat

globule membranes are purified from mouse milk and the protein composition analyzed by SDS-polyacrylamide gel electrophoresis, four major proteins are identifiable with molecular weights of 55, 67, 90, and 150 kDa. The 67-kDa component was identified as butyrophilin and the 150-kDa one as xanthine oxidase. In addition, a high molecular weight carbohydrate rich glycoprotein, PAS-O, is also present. 3 refs., 3 figs.

25116 (LBL—22300, pp 264-266) **High serum levels interfere with the normal differentiated state of avian tendon cells by altering translational regulation.** Valmassoi, J.; Schwarz, R.I. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Primary avian tendon (PAT) cells grown under conditions favorable for retaining the differentiated state respond to high serum levels by disrupting their normal pattern of protein production. The fact that the ascorbate induction process does not proceed through the linked pathway has allowed us to pinpoint the effects of serum on procollagen production. Even in high serum PAT cells maintain their ability to respond to ascorbate by increasing the secretion rate. The expected next step of increasing the translation rate of pro-collagen does not occur. 7 refs., 3 figs., 1 tab.

5503 Cytology

REFER ALSO TO CITATION(S) 25115, 25125, 25155, 25156, 25159, 25160, 25163, 25182, 25183, 25204

25117 (LBL—22300, pp 11-13) **Megakaryocyte fragmentation and platelet formation.** Leven, R.M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

While our understanding of the mechanism of platelet formation is limited, recent experiments describe the subcellular events that occur during platelet formation. The cytoplasm that we observed fragmenting shares ultrastructural and physiological properties with normal platelets. We suggest that stimulated megakaryocyte fragmentation may accurately represent the normal platelet formation mechanism. A model which postulated a breakdown of microfilamentous structures leads to a weakening of the cortical region of the megakaryocytes. The internal cytoplasm, divided by the demarcation membrane system, then separates into long microtubule based fragments, or proplatelets. The proplatelets finally break into individual platelets. 1 ref., 2 figs.

25118 (LBL—22300, pp 200-203) **Improved support films for electron microscopy of beam sensitive specimens.** Taylor, J.R.; Glaeser, R.M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Preliminary results indicate that technical innovations can address the problem of beam-induced movement and provide improved prospects for high resolution imaging of beam-sensitive specimens. Second-generation experiments with microgrid supports are in progress with efforts focusing on the objectives of maximizing the contact between the carbon film and its microgrid support and on improving the flatness of microgrids. When more robust support films are available they will be used in conjunction with small spot illumination. 4 refs., 2 figs.

25119 (LBL—22300, pp 205-206) **Low temperature scanning electron microscopy of frozen hydrated lung.** Bastacky, J.; Hook, G.R.; Finch, G.L.; Goerke, J.; Clements, J.; Gilbert, J.; Conhaim, R.; Lee, C.; Rubinsky, B.; Barr, J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The air-liquid interface of the airways and alveoli in the lung produces functionally significant surface forces. The configuration of this interface, however, is in question because electron microscope sample preparation methods generally remove tissue water. We have developed techniques to study the normal structure of mammalian lung in the frozen hydrated state with water preserved as ice, using the low-temperature scanning electron microscope (LTSEM) of Pawley and Norton. 4 refs., 1 fig.

25120 (LBL—22300, pp 207-208) **High voltage electron microscopy of unsectioned human lung alveolar walls.** Bastacky, J.; Hayes, T.L.; Ackland, D.W.; Parra, S.; Takaro, T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We found the highly energetic (1.5 MeV) beam of the high voltage electron microscope (HVEM) able to penetrate whole-mount unsectioned alveolar walls. Thus, it is possible to simultaneously image the two surfaces of the wall and the internal contents of the wall. The result resembles a high-resolution scanning electron microscope (SEM) surface image with a superimposed transmission electron microscope (TEM) image of internal structure. The composite image resembles a freeze-fracture image; however, this technique has the advantage that the specimen is still present. 6 refs., 1 fig.

25121 (LBL—22300, pp 254) **Human mammary epithelial cell culture.** Stampfer, M.; Bartley, J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Our laboratory has developed culture systems that permit long term active growth of human mammary epithelial cells (HMEC) derived from both normal tissues (reduction mammoplasties) and mastectomies. Additionally, we have created the first non-tumor-virus transformed immortalized cell lines from normal human epithelial cells. The availability of large numbers of these cells allows biochemical, immunological, and molecular investigations of the normal and abnormal mechanisms involved in human epithelial cell growth control, differentiation, and carcinogenesis. The development of serum-free medium for the growth of these HMEC has further enhanced their usefulness.

25122 (RERF-TR—14-86) **Measurement of in vivo HGPRT-deficient mutant cell frequency using a modified method for cloning human peripheral blood T-lymphocytes.** Hakoda, Masayuki; Akiyama, Mitoshi; Kyoizumi, Seishi; Kobuke, Kyoko; Awa, A.A. (Radiation Effects Research Foundation, Hiroshima (Japan)). Jul 1987. 15p. (In English and Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752296/JAW.

Approximately 80 % of human peripheral blood T-lymphocytes could be cloned in the presence of crude Interleukin-2, phytohemagglutinin, and X-irradiated autologous lymphocytes and Raji B-cells. This modified cloning method was used to measure the in vivo frequency of HGPRT-deficient mutant T-lymphocytes. Repeated experiments using blood from the same individuals revealed that the frequency of mutant cells was almost constant for each individual even though the cloning efficiency of lymphocytes varied somewhat from experiment to experiment. Approximately 80 % of both wild-type unselected and 6-thioguanine-resistant colonies had helper/inducer and about 20 % had suppressor/cytotoxic T-lymphocyte markers. No difference was observed in the distribution of lymphocyte subsets between wild and mutant lymphocyte colonies.

5504 Genetics

REFER ALSO TO CITATION(S) 24324, 24332, 25107, 25108, 25114, 25178, 25179

25123 (LBL—22300, pp 227-229) **Genetic and physical studies of repair and recombination in yeast.** Game, J.C.; Mortimer, R.K.; Schild, D.; Cook, V.; Sutton, S. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Studies on DNA repair and recombination in yeast using genetic and biophysical methods are reported. Progress has been made in x-ray repair and meiosis. The role of the excision-repair genes RAD1 and RAD 3, known to be important in the repair of thymine dimers after ultraviolet radiation, have been examined in x-ray repair. These genes play an important role in x-ray repair that is only evident when other pathways of x-ray repair are blocked. Double mutants blocked in the RAD51 and RAD18 pathways are significantly less x-ray sensitive than triple mutants blocked in these

pathways but also mutant in either the RAD1 or RAD3 genes. We believe that this implies that a type of x-ray damage exists that can be repaired by any of the three pathways, so that it is not a significant cause of lethality unless all pathways are blocked. 2 refs., 1 fig.

25124 (LBL—22300, pp 255) **Expression of known oncogenes in human mammary epithelial cells.** Stampfer, M.; Li, Ming; Koszdin, K.; Bissell, M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We have begun studies with our human mammary epithelial cell (HMEC) cultures to determine the possible role of known oncogenes and proto-oncogenes in normal and aberrant growth control in vitro. We are screening different HMEC specimens for presence and expression of various oncogenes. The oncogene probes utilized thus far are human c-Ki-ras, human c-Ha-ras, human c-mos, human c-myc, mouse int-1, mouse int-2, v-src, v-sis, v-Ki-ras, and v-erb-B. 1 tab.

25125 (LBL—22300, pp 261-263) **Influence of extracellular matrix and its components on casein gene expression in mouse mammary epithelial cells.** Li, Ming Liang; Aggeler, J.; Farson, D.A.; Hatier, C.; Bissell, M.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

When primary mouse mammary epithelial cells are cultured on plastic, they rapidly lose their ability to synthesize and secrete most milk proteins even in the presence of lactogenic hormones, whereas cell cultured on released type I collagen gels show greatly enhanced mRNA levels and rates of secretion of β-casein and of some other milk proteins. We show here that cells cultured on a reconstituted basement membrane from Engelbreth-Holm-Swarm (EHS) tumor allows more than 90% of cells to produce high levels of β-casein. By comparison 30-40% of cells on released type I collagen gels and only 2-10% of cells on plastic express β-casein after 6 days in culture (Fig. 1). Because only 40% of cells from late pregnant gland produced β-casein before culture, the EHS matrix can both induce and maintain an elevated level of casein gene expression. 4 refs., 3 figs.

5505 Metabolism

REFER ALSO TO CITATION(S) 24228, 24229, 25104, 25128, 25147, 25157, 25161, 25184, 25193, 25205

25126 (LBL—22300, pp 179-180) **Analytic ultracentrifugation of lipoproteins: Some current collaborations.** Lindgren, F.T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

This summary briefly reports on three ongoing studies - the heterogeneity of Low Density Lipoproteins (LDL) in the cynomolgus monkey, the domain nature of Apolipoprotein E-3, and the molecular weight of apoB-100 in low density lipoprotein subfractions in normal males. 4 refs.

25127 (LBL—22300, pp 191-192) **Synthesis of lecithin:cholesterol acyltransferase by the human liver cell line.** Forte, T.M.; Thrift, R.T.; Cahoon, B.E.; Chen, Ching-Hong; Albers, J.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The enzyme lecithin:cholesterol acyltransferase (LCAT) is a key enzyme in the metabolism of plasma lipoproteins. This enzyme is responsible for the esterification of cholesterol. The cholesteryl ester formed is ultimately catabolized by the liver; hence, it is thought that LCAT plays an essential role in removal of excess cholesterol from plasma. It has long been thought that the liver is the chief site of synthesis of LCAT, since plasma LCAT is low in patients with severe liver disease, and LCAT has been detected in rat liver perfusates. The synthesis and secretion of this enzyme by human liver parenchymal cells has yet to unequivocally demonstrated. We determine that this important enzyme is secreted by the human liver cell line, Hep G2.

5506 Medicine

REFER ALSO TO CITATION(S) 24846, 24847, 24964, 25233, 25475, 25477

25128 (DOE/ER/60528—01) **Radiolabelled D_2 agonists as prolactinoma imaging agents: Progress report for period February 1, 1987-January 31, 1988.** Otto, C.A. (Michigan Univ., Dearborn (USA)). 7 Nov 1987. Contract FG02-87ER60528. 8p. NTIS, PC A02. Order Number DE88004658/JAW.

Three D_2 agonists, ^{3}H-DHEC, ^{3}H-BrCr and ^{3}H-ADTN, were evaluated with ^{3}H-DHEC showing the most promise as a potential prolactinoma imaging agent. Concentration vs time plots for all three compounds in normal and in DES-treated pituitary tissue are reported. The exceptional D_2 receptor affinity of N-0437 has prompted synthetic efforts towards preparation of iodo-N-0437 in spite of a lack of preliminary tissue distribution data. An evaluation of ^{18}F-FDG uptake in the prolactinoma model and as a muscarinic ligand in control animals were evaluated. 2 refs., 3 figs.

25129 (GSF—16/87) **Immunohistochemical investigations of xenotransplanted human adenocarcinomas on nude mice: Correlation to radioimaging.** Matejkova, E. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Abt. fuer Nuklearbiologie; Muenchen Univ. (Germany, F.R.). Fachbereich Tiermedizin). 1987. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752034/JAW.

Immunohistochemical investigations of xenotransplanted human adenocarcinomas on nude mice; correlation to radioimaging Human carcinomas were subcutanously grafted to nude mice (Balb/c-nu/nu) and were investigated in four passages by immunohistochemical methods and by the fluorochrome bisbenzimid. In this way there could be observed a successful differentiation between the nourishing murine stroma and the human tumor parenchym. Especially the use of a monoclonal antibody (rat/mouse fusion) directed against human tissue turned out to be a suitable method. Four adenocarcinomas were tested: Colon-, mamma-, stomach- and testicle carcinoma. During the first four passages atypical parts of murine connective tissue and some changes in the human parenchyma could be seen. These results demonstrate that also in nude mice variations of the transplanted tumor material could happen. They could be detected in time with a routine immunohistochemical test. The consequences of tumor morphological variations for the development of therapeutic and diagnostic tools were studied with the help of radioimaging by external scintigraphy. Furthermore the biodistribution, tumoruptake and the whole body counting were studied by means of radionuclid marked monoclonal antibodies. The morphological variations of the passages of mammary, testicle and colon carcinomas were not big enough to influence the results in a certain way. Therefore especially the relation between the activity uptake in the tissue, the size of the tumor and the whole body uptake was studied in view of immunoscintigraphy.

25130 (IAEA-R—4298-F) **Optimization and field trial of nuclear medicine procedure for the detection of congenital hypothyroidism in a developing country. Final report for the period 15 December 1985 - 15 August 1986.** Arnaldo Foradori, C. (Universidad Catolica de Chile, Santiago). (International Atomic Energy Agency, Vienna (Austria)). Aug 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701813/JAW.

The optimization of the method for screening of neonatal hypothyroidism was done on the basis of local preparation of the necessary reagents like anti T4 rabbit antibody, radioactive tracer and goat antirabbit second antibody with the elimination of commercially available reagents kits. The blood sampling was performed using absorbing paper and T4 concentration was checked. The selection of T4 RIA was due to the robustness of the method and its easy reproducibility in comparison with TSH-RIA. In a group of 2000 newborns in Chile, three cases with neonatal hypothyroidism were found. One of them died within 72 hours because of multiple congenital defects while the two others with high TSH and low T4 are under current L-thyroxine treatment. The results

obtained show the frequence of 3 cases of neonatal hypothyroidism out of 2000 newborns. This result is similar to results published in other Latin American countries, but higher than in Europe and USA. 14 refs, figs and tabs.

25131 **(INIS-BR—926) Modifications of hepatic-splenic scintilography after the partial splenic embolization.** Silva, L.S.; Ramos, C.O.P.; Andrade, J.V.; Boasquevisque, E.M.; Pinheiro, R.S.A.; Souza, A.L.B.; Calcado, A.B.; Penha, M.E. (Sociedade Brasileira de Radiologia, Sao Paulo). 1986. 1p. (In Portuguese). (CONF-8611223—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88701742/JAW.

From 18. meeting on radiology from Rio de Janeiro; 10. meeting on radiology residents from Rio de Janeiro; Rio de Janeiro, Brazil (19 Nov 1986).

25132 **(INIS-BR—931) Radiological, clinical, hystological correlation of breast lesions radiologicaly suspicious.** Torres Neto, G.; Azevedo, C.M. de; Matushita, J.P.K.; Ramos, E.M. (Sociedade Brasileira de Radiologia, Sao Paulo). 1986. 1p. (In Portuguese). (CONF-8611223—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88701744/JAW.

From 18. meeting on radiology from Rio de Janeiro; 10. meeting on radiology residents from Rio de Janeiro; Rio de Janeiro, Brazil (19 Nov 1986).

25133 **(INIS-BR—933) Ultrasonography on diagnosis of intra abdominals complication in VP derivation.** Goncalves, E.G.; Tannus, J.K. (Sociedade Brasileira de Radiologia, Sao Paulo). 1986. 1p. (In Portuguese). (CONF-8611223—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88701745/JAW.

From 18. meeting on radiology from Rio de Janeiro; 10. meeting on radiology residents from Rio de Janeiro; Rio de Janeiro, Brazil (19 Nov 1986).

25134 **(INIS-mf—10797) Study of the global and regional ventricle function using radionuclide ventriculography in the cases of patients with and without KHK under nitrate and placebo.** Kroth, B. (Ulm Univ. (Germany, F.R.). Fakultaet fuer Klinische Medizin). 6 May 1983. 175p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88752015/JAW.

In a controlled study of 74 patients with coronary heart disease (KHK) or without provable heart disease the ventricle function at rest and under ergonomic load before and after oral administration of nitrates, respectively placebos was studied with the help of radionuclide ventriculography. Radionuclide ventriculography proved itself thereby as a valuable method of high sensitivity for the recognition of KHK. The stress test increases the sensitivity and allows inferences to be made on the extent of the ischemia. The global function at rest is more a parameter for the functional restriction by infarct scars. A quantitative regional evaluation also makes possible the recognition of minor local changes. The additional study after nitrate administration allows a basis for the extent of reversibility in the stress-dependent functional restriction. The effects of a drug therapy become extrinsically presentable as a result of radionuclide ventriculography. (TRV).

25135 **(INIS-mf—11616) Aerosols and the lungs. Summary of the 1st Grafschaft colloquium, Schmallenberg.** (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Schmallenberg (Germany, F.R.). Inst. fuer Toxikologie und Aerosolforschung - Teilinstitut Grafschaft). 1987. 9p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752013/JAW.

The lectures of the colloquium are discussed in summary form. There were 5 lectures on aerosol deposition, 5 on aerosol elimination, 7 on toxicology, and 7 on the uses of aerosols in medical therapy. In some cases aerosols with radioactive labels were used. Several lectures reviewed the kinetics and toxicology of airborne environmental pollutants.

25136 **(INIS-mf—11643) Pre-operative irradiation with rectal carcinoma - clinical practices and results.** Rendl, H. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1986. 100p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88752657/JAW.

The goal of this work is to portray the effect of a high-dosed short-timed pre-irradiation on intra- and post-operative therapy of rectal carcinoma and the appearance of recidivistic tumors, respectively distant metastasis. This intermediate balance should help make the decision easier as to whether to continue to use this combined treatment form. The subjects consisted of 65 rectal carcinoma patients - pre-irradiated and operated - and 95 only operated patients. The irradiation was completed using a 8 MeV linear accelerator with ultra hard x-radiation. Dosing - (more than 80%) as short-timed irradiation with 16 Gy (4 x 4 Gy in 2 days) - 25 Gy (10 x 2,5 Gy in 12 days); average field size 150 mm x 150 mm. There were no significant differences with regard to intra- and post-operative complications, late complications or distant metastasis, but there was with tumor recidivision reduced with pre-irradiated. Regarding the survival rate, there was a slight tendency in favor of the pre-irradiated.

25137 **(INIS-mf—11644) Radioimmunological determination of dehydroepiandrosterone sulfate in premature, mature and deficient born children as a parameter in the determination of the functional condition of the fetal adrenal cortex.** Grueters, A. (Freie Univ. Berlin (Germany, F.R.)). 8 Oct 1982. 63p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752658/JAW.

The starting point of this work was the question of a correlation between serum concentration of dehydroepiandrosterone sulfate (DS) and gestation age. It was shown that after the sixth day of life, a negative correlation existed between the DS concentration in the serum of neonates and their gestation age. With non-stressed neonates DS can be used as a parameter of maturity. Vaginal birth and severe illness of premature, respectively newborn children cause a massive stimulation of DS secretion through the fetal zone of the adrenal cortex. Between the DS concentrations and the prolactin levels no correlation could be proven, so that there can be no discussion of prolactin as an alternative stimulator on the fetal zone of the adrenal cortex. The DS values presented in this work for premature and mature neonates of varying gestation age can be used as reference values by pediatric endocrinologists for the evaluation of a newborn with the suspect diagnosis of an adrenogenital syndrome or an adrenal insufficiency. The DS-radioimmunoassay is a practicable method for newborns because of its simplicity, quickness, and demand for only small amounts of serum and it is sufficiently specific and provides a good statement about the functional condition of the adrenal gland of newborns.

25138 **(INIS-mf—11645) Bronchial and pulmonary scintigraphy with radioactively marked aerosols.** Wuerstle, T. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 2 Dec 1982. 147p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number TI88752659/JAW.

In 97 patients with bronchitis, bronchial asthma, tuberculosis, sarcoidosis, pneumoconiosis, or tumors the mucociliary clearance and/or deposit pattern after inhalation of radioactively marked aerosols (1 mCi 99m Tc sulfur colloid) was studied. Normal values of the mucociliary 30 min. clearance for the central bronchial/lung periphery are 21%/15%. There was a decreased clearance with bronchitis (11/8%), bronchial asthma, emphysema, tuberculosis, sarcoidosis, trachiobronchial amyloidosis, pleural scarring or interstitial pneumona. Increased clearance (29/19%) was shown with pneumoconiosis. The correlation of deposit pattern and disease, for example, bronchitis, bronchial asthma, bullous emphysema, pleural scarring, partial lung resection, bronchopneumonia, or bronchial restriction, is described. In comparison of aerosol scintigraphy to perfusion scintigraphy and ventilation with gaseous xenon, the aerosol scintigraphy is superior to xenon for certain indications. The aerosol particles, which are larger in comparison to xenon, settle easier by obstructions or flow variations and thereby give better clinical indications of regional differences.

25139 **(INIS-mf—11646) Radioimmunological determination of follicle stimulating hormone in the serum of patients with various gonadal disturbances.** Otte, P. (Frankfurt Univ. (Germany, F.R.). Fachbereich Humanmedizin). 22 Feb 1982. 224p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number TI88752660/JAW.

A new kit for FSH determination in the serum was tested: the precision, sensitivity and specificity of this kit were adequate. With 185 men and 99 women with various hypophyseal and gonadal disorders the serum FSH was determined in radioimmunoassay as a supplement for diagnostic. Patients with hypophyseal tumors had to some extent pre-operatively increased and after hypophysectomy in general subnormal FSH values. Male patients with primary hypogonadism had without substitution therapy inclusively distinct to pronounced FSH level increases. With young patients with gynecomastia FSH values which lay primarily in the normal range were measured. Female patients with primary ovarial insufficiency often indicated very sharp increases in FSH levels. Female patients with Turner syndrome showed high FSH values at puberty age. In girls with hyposomia and hypogonadism high FSH levels refer accordingly to such a syndrome.

25140 **(INIS-mf—11654) Comparison of various evaluation methods by means of camera-function scintigraphy of stomach evacuation. A study of ulcer patients before and after various stomach operations and of healthy subjects on test diets with the addition of different hydrophilic matter.** Haeussler, M. (Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet). 16 Jun 1982. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752663/JAW.

The purpose of this work is the study of the influence of hydrophilic matter in test diets on the stomach evacuation by the use of camera-function-scintigraphic methods and by the use of various evaluation procedures on a large collection of evacuation studies. With 10 healthy subjects who had received a mash-type test diet with 99m Tc DTPA without as well as with the addition of pectin and bran, there was no evident influence of the addition of hydrophilic matter on the stomach evacuation. For the evacuation function of 135 healthy subjects and patients with various stomach diseases exponential functions, lines, quadratic functions and 'gamma-variate' were fitted and valued according to their advantages and disadvantages. The evacuation curves of 88 of these subjects were evaluated additionally by the main component method. It was shown thereby that there was an initial accelerated evacuation in patients who had undergone a selective proximal vagotomy with pyrolo plastic, and a less evident and not always present accelerated evacuation in patients who had undergone a selective proximal vagotomy without pyrolo plastic. The main component method is only with restrictions suited for stomach evacuation studies in the framework of clinical diagnostic because of its great complexity. (TRV).

25141 (LBL—22300, pp 4-7) **Radiolabeling of metalloporphyrins for imaging vascular plaques and lesions.** Yano, Y.; Singh, M.; Brennan, K.M.; Dalal, K.B.; Mathis, C.A.; Ebbe, S.N.; Budinger, T.F.;. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Porphyrins and metalloporphyrin have been shown to accumulate in atheromatous plaques and lesions. The accumulation of hematoporphyrin derivative (HPD) in atheromatous plaques in the aorta of hyperlipidemic rabbits, monkeys, and humans have been detected by fluorescence while no fluorescence was seen in aortic segments free of plaque. Paramagnetic manganese as the tetrakis(p-sulfophenyl) porphyrin ($MnTPPS_4$) has been used to enhance proton relaxation in nuclear magnetic resonance studies that showed selective uptake of $MnTPPS_4$ in atheromatous plaques. The sensitivity of radiolabeled porphyrin and positron emission tomography would be much greater for localizing vascular lesions. The development of a high resolution PET system with a resolution of about 2 mm has greatly increased the potential for detecting atheromata or vascular lesion. The purpose of the present study was to label various porphyrin compounds with radionuclides and to determine their uptake in normal and balloon-catheter de-endothelialized rabbit aortas or in hyperlipidemic-rabbit aortas. Another means of imaging vascular lesions is by single photon emission computed tomography (SPECT) for application to more widely useful nuclear medicine studies. 3 refs., 1 fig., 3 tabs.

25142 (LBL—22300, pp 14-16) **^{123}I-labeled radiopharmaceuticals for in vivo imaging of low-density lipoprotein metabolism.** Moerlein, S.M.; Dalal, K.B.; Ebbe, S.N.; Yano, Y.; Brennan, K.M.; Neben, T.; Twitchell, J.A.; Carpenter, D.A.; Budinger, T.F. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

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We have shown using a rabbit model of hypercholesterolemia, that [^{123}I]TC-LDL is superior to [^{123}I]LDL as a radiopharmaceutical for noninvasively studying the metabolic fate of this plasma protein. Future applications of this agent include the imaging of various patient populations to better understand the physiological mechanism of LDL catabolism in human health and disease. 4 refs., 1 fig.

25143 (LBL—22300, pp 16-18) **Positron emission tomography for diagnosis of radiation necrosis and recurrent brain tumor.** Valk, P.E.; Budinger, T.F. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

High-dose radiation therapy is the most effective treatment for high-grade primary brain tumors, but is associated with a risk of fatal radiation necrosis. The clinical features of radiation necrosis are very similar to those of tumor recurrence and differentiation of the two is frequently difficult. Appearances of the two conditions on x-ray CT, magnetic resonance imaging, and angiography can be identical, and differential diagnosis frequently requires surgical biopsy. Functional imaging by positron emission tomography (PET) provides a new approach to this diagnostic problem and we have used PET with rubidium-82 (^{82}Rb)^{2} and ^{18}F-2-fluoro-2-deoxyglucose (^{18}F-FDG)^{3} to distinguish recurrent tumor from necrosis in this patient group. 4 refs., 1 fig.

25144 (LBL—22300, pp 18-20) **Brain blood flow in Alzheimer's disease measured with iodine-122 and positron emission tomography.** Sargent, T. III; Mathis, C.A.; Jagust, W.J.; Kusubov, N.; Budinger, T.F. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

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It appears from this group of three patients that regional cerebral brain blood flow is closely coupled to regional metabolic rate in Alzheimer's disease. If this is the case with a larger series of patients, the rCBF measurement could be used to supplant the more expensive and time consuming ^{18}FDG studies. The method should also have utility in measurement of flow-metabolism coupling in great variety of other brain disorders, or of flow alone, the latter especially in studies on normal subjects in which brain function is manipulated experimentally to measure flow changes during normal brain function. 1 fig., 1 tab.

25145 (LBL—22300, pp 21-22) **Regional cerebral blood flow and metabolism in stroke.** Jagust, W.J.; Mathis, C.A.; Budinger, T.F.; Valk, P.E.; Weinstein, P.R. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Divisions: Annual report 1986.

Positron emission tomography is capable of making quantitative measurements of processes including cerebral blood flow and metabolism that have important implications for the study of stroke. The exact relationship between blood flow and metabolism is of crucial importance in brain tissue, since at some low flow values tissue may still be able to meet its metabolic needs by extracting more glucose from the blood. This introduces the concept of the "ischemic penumbra," which defines the relationship between flow and metabolism in the area around an infarct. The identification of this ischemic penumbra is of great importance, because therapeutic measures that may increase blood flow to this region can potentially diminish the size of the final infarct, resulting in a better clinical outcome for the patient. Our analysis of this problem has made use of two tracers, one for measuring blood flow and one for measuring metabolism. 1 fig.

25146 (LBL—22300, pp 23-25) **Single photon emission computed tomography: A practical clinical modality for the laboratory diagnosis of dementia.** Jagust, W.J.; Budinger, T.F.; Reed, B.R.; Seab, J.P.; Colina, M.M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Divisions: Annual report 1986.

This study was designed to investigate whether SPECT measurements of regional cerebral blood flow (rCBF) are capable of demonstrating the same temporoparietal deficits that have been seen in PET studies of glucose metabolism, and to evaluate the utility of SPECT in differentiating patients with varying clinical severities of Alzheimer's Disease (AD) from the healthy control subjects and patients with multiple stroke or multi-infarct dementia (MID). N-isopropyl-p-iodoamphetamine (IMP), labeled with ^{123}I is distributed in brain in proportion to blood flow and when scanned topographically, can provide three-dimensional information about rCBF. We studied nine patients with AD. Two patients with MID were studied. 1 fig.

25147 (LBL—22300, pp 34-36) **Fluorodeoxglucose effects on glucose metabolism in nuclear magnetic resonance (NMR) studies.** Brennan, K.M.; Budinger, T.F.; Twitchell, J.A.; Bristol, K.S. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

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The PET studies clearly show an effect of ^{19}FDG loading on ^{18}FDG kinetics. There was a decrease in brain accumulation of ^{18}FDG in animals who received a loading dose of ^{19}FDG and the rate of washout for ^{18}FDG is greater in the loaded than in the control animals. These animals were under anesthesia. The amount of ^{19}FDG given in previous NMR studies is 2 to 3 times higher than the doses used here. The fact that even at these lower doses we find an effect on the kinetics of FDG, which is counter to our experience in human, dog, cat and rabbit studies as well as biochemical studies by others, argues for caution in conclusions regarding glucose metabolism and biochemistry in tissues exposed to elevated doses of fluorodeoxyglucose. 8 refs., 3 figs., 2 tabs.

25148 (LBL—22300, pp 37-40) **An instrument control and data analysis program for imaging and in vivo spectroscopy.** Roos, M.S.; Mushlin, R.A.; Veklerov, E.; Port, J.D.; Ladd, C.; Harrison, C.G. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The spectrometer control data processing environment and the libraries of macros designed are used to support imaging and in vivo spectroscopy at the Lawrence Berkeley Laboratory, the Massachusetts Institute of Technology, and the Brigham and Women's Hospital in systems ranging from a 2-T animal spectrometer to a 0.5-T whole body imager. Experiments that have been successfully implemented include multi-slice, multi-echo imaging fast steady state free precession imaging and ^{31}P spectroscopy. The flexibility of the macro programming structure allowed very rapid development of these macro libraries. We have demonstrated that instrumentation developed around standard hosts, buses, and operating systems can yield research tools with performance comparable to highly specialized systems. The combination of low macro instruction overhead, provision of user access to system internals, and a rich command set controlling basic acquisition and processing functions provides a foundation on which libraries of macros may be built to serve a broad range of users, perhaps more easily than a system with larger sets of less primitive commands and a more limited batch processor. Well defined program interfaces for macros and for installing commands, as well as the ability to modify instrument control code significantly broaden the range of experiments accessible to the researcher.

25149 (LBL—22300, pp 152-153) **Beam delivery systems for heavy charged particle therapy at the Bevalac.** Alpen, E.L.; Chu, W.T.; Ludewigt, B.A.; McEvoy, M.B.; Nyman, M.A.; Renner, T.; Singh, R.P. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The wobbler system has now been used for one year in treating over 25 patients. In the last five months of full-time operation 18 patients have been treated for a total of 255 treatments. Its reliability and consistency have been comparable to that of the double-scattering system previously used for patient treatment. Neon ions of an energy per nucleon of 456 and 585 MeV, corresponding to clinically usable ranges at treatment isocenters of 18.6 and 27.6 cm of water equivalent thicknesses, respectively, have been developed. 3 refs.

25150 (LBL—22300, pp 154-157) **Radiation therapy tolerance doses for treatment planning.** Lyman, J.T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

To adequately plan acceptable dose distributions for radiation therapy treatments it is necessary to ensure that normal structures do not receive unacceptable doses. Acceptable doses are generally those that are below a stated tolerance dose for development of some level of complication. To support the work sponsored by the National Cancer Institute, data for the tolerance of normal tissues or organs to low-LET radiation has been compiled from a number of sources. These tolerance dose data are ostensibly for uniform irradiation of all or part of an organ, and are for either 5% (TD_5) or 50% (TD_{50}) complication probability. The "size" of the irradiated organ is variously stated in terms of the absolute volume or the fraction of the organ volume irradiated, or the area or the length of the treatment field. The accuracy of these data is questionable. Much of the data represent doses that one or several experienced therapists have estimated could be safely given rather than quantitative analyses of clinical observations. Because these data have been obtained from multiple sources with possible different criteria for the definition of a complication, there are sometimes different values for what is apparently the same end point. 20 refs., 1 fig., 1 tab.

25151 (LBL—22300, pp 162-164) **Heavy charged particle radiotherapy.** Castro, J.R.; Phillips, T.L.; Linstadt, D.; Berson, A.; Woodruff, K.H.; Gauger, G.E.; Gutin, P.H.; Collier, J.M.; Henderson, S.D.; Petti, P.L. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The heavy charged particle radiotherapy trial accused 96 patients in 1985, with an additional 15 patients receiving control irradiation. The total number of patients treated through October 1986 was 921 with another 60 patients treated as low-LET controls. All patients have been treated on Phase I, II and III clinical research protocols.

25152 (LBL—22300, pp 165-173) **Stereotactic heavy charged particle Bragg peak radiosurgery.** Fabrikant, J.I.; Frankel, K.A.; Phillips, M.H.; Lyman, J.T.; Alpen, E.L.; Manley, N.B.; Levy, R.P.; Lo, E.; Foster, M.L.; Hampton. G.T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Deep and surgically-inaccessible intracranial arteriovenous malformations (AVMs) have not been treated until the last two decades, primarily because of their variable symptoms, changeable pathoanatomical relationships, and inaccessibility to vascular brain surgery. Recently developed neuroradiological imaging and microsurigical techniques are now making certain of the deep AVMs potentially amenable to treatment. However, serious limitations to neurovascular surgical or interventional neuroradiological procedures may exist in the case of deep AVMs, because of location, size, patient condition, or other factors. Conventional radiotherapy as a method of induced thrombosis has been attempted in the past, but has been generally abandoned as unsuccessful. However, stereotactic heavy charged-particle Bragg-peak radiosurgery currently being developed holds considerable promise for the treatment of those life-threatening intracranial vascular disorders that are surgically inaccessible. Evaluation and treatment with stereotactically directed narrow beams of heavy ions in approximately 225 patients in our laboratory, plus extensive clinical and neuroradiological follow up, indicates that heavy charged particle radiosurgery obliterates intracranial arteriovenous malformations or protects against rebleeding with considerable reduction in mobility and mortality. 6 figs.

25153 (LBL—22300, pp 173-175) **The future for research with accelerated nuclei: BUG and LIBRA.** Tobias, C.A.; Gough, R.A.; Shirley, D.A.; Rosenblatt, G.M.; Silverman, P.H.; Berkner, K.H.; Budinger, T.F.; Castro, J.R.; Fabrikant, J.I. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

LIBRA may be the first biomedical accelerator that will be designed to take full advantage of radioactive secondary beams. These are formed from the primary beam, when the particles are passed through a thin slab of matter, (usually beryllium). The secondary radioactive particles are magnetically separated from the particles in the primary beam and are focused in a separate beam. Table 2 lists the radioactive beam species that can be produced by LIBRA. The machine will use highly automated computerized control systems so that its operation will be simple and the reliability of its operation should approach that of conventional x-ray or electron equipment used in medicine. The beam intensity of the carbon beams will be about 3 x 10^{-10-11} particles per minute, ample for most applications. 1 fig., 2 tabs.

5507 Microbiology

REFER ALSO TO CITATION(S) 24231, 24234

25154 (LBL—22300, pp 249-250) **Quantitative immunocytochemical assay for avian retroviruses.** Stoker, A.W.; Bissell, M.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Much of our work revolves around the use and study of the avian RNA tumor virus (retrovirus) Rous sarcoma virus (RSV) and its transformation-defective derivatives (tdRSV). Throughout this work, it is necessary to obtain and monitor the integrity of high titer stocks of our viruses for the critical work in the embryo. One problem is the maintenance of virus with low titers of tdRSV (which arise spontaneously at high rates in RSV populations), these being direct competitors of RSV for cell infection in vivo and in culture. A second and related problem is posed by the lack of a good assay for such tdRSV, or in fact, any non-transforming avian retrovirus. A commonly used assay quantitates the amount of the viral enzyme, reverse transcriptase (the enzyme that copies the viral RNA genome into a DNA copy in the infected cell) in viral stock. However this assay lacks high sensitivity, and cannot distinguish between RSV and tdRSV viruses. A novel detection system has therefore been developed in our laboratory that utilizes immunocytochemical staining of infected cells in culture to accurately quantitate both RSV and tdRSV. 3 refs., 2 figs.

5508 Morphology

REFER ALSO TO CITATION(S) 25117, 25163

25155 (LBL—22300, pp 251-254) **Developmental regulation of tyrosine phosphorylation substrates calpactin 1 and vinculin in embryonic avian limb and expression in cultured limb cells.** Carter, V.C.; Howlett, A.R.; Martin, G.S.; Bissell, M.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Phosphotyrosine-containing proteins are minor components of normal cells that, in certain instances, are associated with the regulation of cellular metabolism and growth. An increase in the phosphotyrosine content of cellular proteins is observed following transformation by several avian sarcoma viruses. Two of the most prominent cellular substrates are calpactin 1 and vinculin. Both proteins are phosphorylated at tyrosine following transformation by retroviruses. To determine the sites of calpactin and vinculin synthesis frozen sections were prepared and stained with anti-calpactin and anti-vinculin serum.

25156 (LBL—22300, pp 257-259) **Expression of differentiated function in human mammary epithelial cells in culture.** Bartley, J.; Parry, G.; Levine, G.; Stampfer, M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The expression of surface antigens is being determined by the use of monoclonal antibodies developed in response to the human milk-fat globule membrane, which is derived from the apical plasma membrane of mammary epithelial cells. After screening six antibodies for their ability to bind the cell surface human mammary cells, three were selected for further study. The results indicate that antibody P2C1 may be useful in distinguishing between normal cells and those of the transformed lines A1 and B5. Based on the results with expression of milk protein and glycogen synthesis, the surface components reacting with P2C1 is not modulated by the transition from the quiescent to the early prelactational state. In contrast, expression of the surface molecules with affinity for antibodies P2A1 and P3B1 is modulated by the growth medium. The differential staining and the differences in response to growth medium may help to identify stages of differentiation in normal cells and to distinguish between normal and transformed cells in mixed cultures. In those cultures showing fewer than 10% positive cells, treatment of the cells with neuraminidase (designated NM in the table) may help to amplify differences between normal and transformed cells. 1 tab.

5509 Pathology

REFER ALSO TO CITATION(S) 25146

25157 (LBL—22300, pp 7-9) **Morphological and kinetic abnormalities of platelets in hypercholesterolemic rabbits.** Mazoyer, E.; Ebbe, S.; Dalal, K.; Leven, R.; Mazoyer, B.; Brennan, K.; Carpenter, D.; Yee, T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Hypercholestrolemia was produced by feeding rabbits diets supplemented with cholesterol and peanut oil. Arterial blood was collected and analyzed at 1-2 week intervals for 8-12 weeks from rabbits on the special diets and from control rabbits that were fed a normal diet for laboratory rabbits. Serum cholesterol concentrations increased rapidly in rabbits fed a diet with 1% cholesterol and 4% peanut oil and reached about 1800 mg/dl at 8 weeks while they remained at the normal level (<100 mg/dl) in the controls. The hypercholesterolemic rabbits developed aortic atherosclerosis and fatty infiltrates of tissues.

25158 (LBL—22300, pp 9-10) **The effects of hypercholestrolemia on rabbit platelets: Functional and biochemical alterations.** Dalal, K.; Mazoyer, E.; Ebbe, S.; Carpenter, D.; Yee, T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Experimental evidence points to hypercholesterolemia as an important risk factor for atherosclerosis and related occlusive vascular disorders. In spite of considerable support implicating cholesterol, the mechanism of its effect on this group of disorders is not entirely clear. Accumulation of fat and cholesterol in the platelets could influence the development of the initial fatty atheromatous lesions in human beings and animals. Since platelets may have a critical role in atherogenesis, we have examined the mechanisms underlying the relationship among platelets, cholesterol, phospholipid metabolism, and platelet function in rabbits fed diets supplemented with cholesterol (1% and 0.5%) and peanut oil (4% and 2%) 1 tab.

25159 (LBL—22300, pp 45-48) **Hematozoa and erythropoiesis: Effects of malaria infection.** Silverman, P.H.; Mahlmann, L.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Infection with three species of murine malaria resulted in substantial quantities of erythropoietin (Ep) being produced and available in the circulating plasma. It has also been found that colony-stimulating factor (CSF) that regulate the proliferation and

differentiation of granulocytic blood cells are stimulated in increased quantities during infection with malaria. These findings suggest that the dyserythropoiesis observed in malaria-infected hosts might be caused by events inhibiting progenitor differentiation and amplification or the lack of progenitor-cell production by stem cells. 6 refs., 4 tabs.

25160 (LBL—22300, pp 48-51) **Stromal cell changes in mice infected with murine malarias.** Schooley, J.C.; Smith, K.L.; Kullgren, B. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Mice infected with malaria have an elevation in the serum level of colony stimulating factor and erythropoietin, the factors that regulate the differentiation of two hematopoietic cell lines, the granulocytic and the erythroid, and the granulocytic system is stimulated while the erythroid is inhibited. The concept that the dyserythropoiesis of malaria directly results from a reduction in CFU-S appears untenable, since ultimately both granulocytes and erythroid cells are derived from the multipotential progenitor. We have suggested that the dyserythropoiesis may result because the production of erythroid cells from early erythroid progenitors is blocked by some soluble agent generated by mononuclear cells, probably interleukin 1. The data presented here suggest that an additional disturbance in erythropoiesis may result from the reduction of CFU-F and, ultimately, adipocytes in the bone marrow which may limit the energy source for erythropoiesis. 1 tab.

25161 (LBL—22300, pp 187-189) **Low density lipoprotein subclasses and risk of myocardial infarction.** Austin, M.A.; Krauss, R.M. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

This study suggests that low-density lipoprotein (LDL) subclass pattern B, characterized by a predominance of small dense LDL particles, is associated with increased risk of myocardial infarction. The mechanism for this association could be through the associated changes in lipid and lipoprotein profiles, which in turn could be the result of pleiotropic effects of an underlying gene. It is also possible that environmental factors, such as diet and exercise, could influence LDL subclass patterns and lead to potential intervention strategies. 2 tabs.

25162 (LBL—22300, pp 189-191) **A new animal model for genetic hypercholesterolemia.** Fitch, W.L.; Krauss, R.M.; Checovich, W.J.; Attie, A.D. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We have investigated a new animal model of a genetic defect affecting intermediate density lipoproteins (IDL) and low density lipoproteins (LDL) that leads to hypercholesterolemia, premature atherosclerosis, and death in a strain of inbred pigs developed at the University of Wisconsin. We have characterized the LDL particles in controls and mutants according to flotation rate, particle size, and distribution of mass across the density range of IDL and LDL. Pigs with a specific mutation involving apolipoprotein B^1 have very high plasma cholesterol and die of atherosclerosis by 3 years of age, even though normal lifespan of the pig is 15 years. We obtained plasma from five such mutants and from ten control pigs, isolated the IDL and LDL, and performed characterization studies.

25163 (LBL—22300, pp 245-248) **Tissue tropism and temporal expression of Rous sarcoma virus in embryonic avian limb in vivo and after transfer to cell culture.** Howlett, A.R.; Cullen, B.L.; Hertle, M.D.; Bissell, M.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Embryonic avian tissue has been shown to be resistant to the transforming potential of Rous sarcoma virus (RSV) in ovo during the first semester of development; the transformed phenotype is expressed following dissociation of infected tissues and seeding into tissue culture. This suggests that host factors, associated with the in vivo environment of the developing embryo can influence the tumourigenicity of RSV, perhaps by regulating synthesis of inhibitory components or endogenous tumor promoters. Alternatively, the temporal and spatial sequence of the expression of viral and cellular factors within the dynamic developing field of the limb could in some way determine the outcome of host-viral interactions and thereby regulate susceptibility to expression and/or infection (tissue tropism) and competence for transformation. In order to examine the pattern of interactions between virus and host tissues in the chick embryo, monoclonal antibodies specific for the viral structural protein P19/sup gag/ and host tissue determinants, myosin and collagen types I and II were used to identify the early cellular targets for RSV infection and the kinetics of viral spreading in the developing limb bud in vivo and in cultured limb bud cells. Viral transmission in ovo was characterized by a saltatory kinetic with two rapid bursts of infectious spread with intervening periods of stasis. 4 refs., 2 figs., 1 tab.

25164 (PNL—6100-Pt.2, pp 31-33) **Environmental stress and disease in marine animals.** Elston, R.A. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

The objectives of this research are to identify specific infectious disease phenomena in marine animals, and to characterize the molecular, biochemical, and cellular bases for the diseases and their modulation. In addition, the program addresses the effects of environmental stresses on the immune systems of marine animals. It has been necessary to identify and select a number of naturally occurring candidate diseases that are suitable for more detailed study. Consequently, the research for the past year has focused on identifying which infectious diseases are most suitable for the molecular and biochemical studies now beginning.

25165 **Adjusting for covariates that have the same distribution in exposed and unexposed cohorts.** Gail, M.H. (National Cancer Institute, Bethesda, MD). pp 3-18 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

The author examines the effects of omitting a balanced covariate, namely a covariate, X, that has the same distribution among exposed and unexposed subjects, from regression analyses of cohort data. Except for models with linear or multiplicative regressions of the response variable on exposure and X, omission of a balanced covariate yields biased estimates of treatment effect. Moreover, even in cases where bias is not introduced, omitting X can lead to hypothesis tests for no exposure effect that have supranominal size, if the Fisher information is used to estimate required variances. A robust variance estimate is recommended, instead, which leads to tests of nominal size, but omitting X can still lead to substantial power loss. These ideas are discussed in relation to the following models (Table 1) for epidemiological cohort studies: normal linear, exponential multiplicative, exponential reciprocal, Bernoulli logistic, Bernoulli additive, Bernoulli multiplicative, Poisson multiplicative, Cox model, and the proportional hazards model for paired survival data.

25166 **Regression methods for data with incomplete covariates.** Whittemore, A.S.; Grosser, S. (Stanford Univ. School of Medicine, CA). pp 19-34 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Modern statistical methods in chronic disease epidemiology allow simultaneous regression of disease status on several covariates. These methods permit examination of the effects of one covariate while controlling for those of others that may be causally related to the disease. However they do not accommodate data in which one or more covariates are incomplete, e.g., missing or measured with error. This paper uses assumptions about the probability laws governing covariate incompleteness to obtain estimates of re-

gression coefficients relating disease to the unobserved complete covariates. The estimates are obtained by maximizing the likelihood of the observed, incomplete data via the EM algorithm.

25167 **Partial and marginal matching in case-control studies.** Greenland, S. (Univ. of California School of Public Health, Los Angeles). pp 35-49 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

A common problem in epidemiologic studies is the inability to match all study subjects on all potential matching factors. The author examined the effects of partial matching relative to full matching and no matching on the efficiency of case-control designs. For the case of two binary matching covariates, he compared five types of design: unmatched, matched on only one of the two factors, fully matched on both factors, partially matched on both factors, and a design matched on the marginal distribution of both factors. He further compared the unmatched, partially matched, and fully matched designs using a matching factor with five interval-scaled categories. Marginal matching always gave an efficiency nearly equal to full matching. Although the efficiency of partial matching often fell between that of unmatched and fully matched designs, partial matching could sometimes be more or less efficient than the extremes of no matching or full matching as could matching on a nonconfounding correlate of an unmatched confounder. Furthermore, even when partial matching was not the most efficient of the designs it often came close to the best efficiency among the designs when only 60% of the subjects were matched. These results indicate that, in practice, complete matching is unnecessary to produce most of the efficiency benefits (or penalties) of matching. He also compared various analysis options for the study designs, including the option of controlling the matching factor by entering it directly into an unconditional analysis. The results indicate that the latter strategy may be particularly worthwhile for partially matched designs involving small sample sizes.

25168 **Design options for sampling within a cohort.** Prentice, R.L.; Self, S.G.; Mason, M.W. (Fred Hutchinson Cancer Research Center, Seattle, WA). pp 50-62 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Designs are considered which permit efficient relative risk regression estimation without requiring the assembly of covariate histories on all members of a defined cohort. A standard case-control within cohort design is described along with a more structured time-matched design in which a subject can serve as a control in at most one risk set. The latter design is expected to typically give rise to some small efficiency improvement, but at the expense of more complex variance estimation. A case-cohort design is described as an alternative to case-control sampling. This design involves the selection of a (stratified) random subcohort of the entire cohort which then provides the comparison group for all cases, regardless of whether such cases arise within or outside of the selected subcohort. This design is expected to typically give noteworthy efficiency gains relative to the case-control designs. Simulation results permit comparison among these designs in selected circumstances.

25169 **Stanford heart transplantation data revisited: a real-time approach.** Arjas, E. (Univ. of Oulu, Finland). pp 65-81 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

A form of the discrete time logistic regression model is considered as a means to analyze complicated failure time data. A characteristic property of this approach is that the events recorded in the data are always treated in the model in the order in which they occurred in real time, without first aligning them according to some particular basic time measurement. Parametric modeling is used throughout. The technique is illustrated by a detailed analysis of the Stanford Heart Transplantation Data. Computational aspects are discussed briefly.

25170 **Time-dependent covariates and Markov processes.** Andersen, P.K. (Univ. of Copenhagen, Denmark). pp 82-103 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Problems in connection with the cox regression model with time-dependent covariates are studied including possible masking of treatment effects prognostic measures and model evaluation. Possible ways of attacking these problems by means of multivariate counting processes, in particular Markov processes, are discussed. A study of survival with liver cirrhosis is used for illustration.

25171 **Confidence regions for case-control and survival studies with general relative risk functions.** Moolgavkar, S.H.; Venzon, D.J. (Fred Hutchinson Cancer Research Center, Seattle, WA). pp 104-120 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Problems with Wald confidence regions are discussed. Geometric methods are used to construct confidence regions in curved exponential families. These methods are applied to case-control and survival studies with general relative risk functions. Simulations indicate that the geometric procedures have good coverage and power properties.

25172 **Relative risk regression diagnostics.** Lustbader, E.D. (Fox Chase Cancer Center, Philadelphia, PA). pp 121-139 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

This paper suggests a number of techniques for detecting unusual observations that arise in matched case-control studies analyzed under the conditional likelihood of the logistic model and in survival studies analyzed under the partial likelihood of the proportional hazards model. Most of the suggested techniques are extensions of linear regression diagnostics. Appropriate generalizations of residuals, leverage, and influence are provided. In addition, diagnostic statistics related to hypothesis testing are discussed. Matched case-control and survival data present unique problems in interpretation of diagnostics due to the grouping of individuals in risk sets. In survival studies, the appearance of one individual in many risk sets presents another grouping problem for diagnostics. Reasonable approximations to minimize the computational burden of grouping are proposed. The diagnostics are illustrated using the data collected on patients enrolled in the Stanford Heart Transplant Program.

25173 **Example of dependencies among variables in a conditional logistic regression.** Davis, C.E.; Hyde, J.E.; Bangdiwala, S.I.; Nelson, J.J. (Univ. of North Carolina, Chapel Hill). pp 140-147 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Conditional logistic regression analysis of a matched case-control study investigating the relation between apolipoprotein A-1 and coronary death, adjusting for known risk factors, identified collinearity among the variables. Application of the Belsley, Kuh and Welsch diagnostic method to the X matrix, the pooled covariance

matrix and the information matrix at the solution, indicates that the dependency would have been detected only by considering the information matrix at the solution.

25174 **Model for bivariate survival data.** Oakes, D. (Univ. of Rochester, NY). pp 151-166 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

A model proposed by Clayton for bivariate survival data is discussed. The joint distribution of the two survival times is absolutely continuous, a single parameter governs the association between the two survival times and the marginal distributions may be specified arbitrarily. Motivation for, and properties of, the model are given. Published and unpublished results for parametric and semi-parametric inference about the association parameter are surveyed. The techniques are illustrated by simple example, which includes a brief consideration of goodness-of-fit.

25175 **Incorporating random effects into multivariate relative risk regression models.** Self, S.G.; Prentice, R.L. (Fred Hutchinson Cancer Research Center, Seattle, WA). pp 167-178 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

An approach for modeling multivariate failure time data is described in which random effects are incorporated into relative risk regression models. An ad hoc method of estimation is proposed for these models which is very similar to the partial likelihood methods used in univariate problems. A large sample theory for the estimators is described. Possible extensions and potential applications of these models are discussed.

25176 **Use of the power transform to discriminate between additive and multiplicative models in epidemiologic research.** Breslow, N. (Univ. of Washington, Seattle). pp 181-196 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

The Box-Cox power transform provides a convenient way to distinguish additive from multiplicative models for rates fitted to grouped cohort data, and additive from multiplicative relative risk functions fitted to grouped or continuous case-control data. The maximum likelihood calculations are programmed as a problem in iterated weighted least squares; by-products of those calculations are useful in assessing model stability and goodness-of-fit. The score test for the unknown exponent in the power transform coincides with Pregibon's goodness-of-link test for generalized linear models. An example shows that extensive data may be needed to reliably distinguish between such models.

25177 **Use of auxiliary information in fitting nonproportional hazards models.** Thomas, D.C. (Univ. of Southern California, Los Angeles). pp 197-210 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Alternatives to the proportional hazards model are considered, including models in which time and covariate effects combine additively, and models derived from the multistage theory of carcinogenesis. Such models can be fitted to cohort data without reference to external rates or parametric assumptions about the time dependence using the full likelihood by using the rates in the entire cohort. Some models may be fitted more easily by exploiting a factorization of the likelihood into the product of Cox's partial likelihood and a Poisson regression likelihood. In order to fit case-control data, external rates or control sampling fractions must be known. Applications to data on lung cancer in a cohort of Quebec asbestos workers are described.

25178 **Modern methods of segregation analysis.** Elston, R.C. (Louisiana State Univ. Medical Center, New Orleans). pp 213-224 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Classical segregation analysis was concerned with the detection of Mendelian inheritance by analyzing dichotomous variables observed on the members of sibships. Modern segregation analysis is similarly concerned with the detection of Mendelian inheritance, but the variables may be quantitative and they may be observed on members of larger family structures. Two general models that each subsume monogenic Mendelian inheritance as a special case have been proposed for hypothesis testing and parameter estimation, using likelihood methods. There are four components to each model: the joint genotypic distribution of mating individuals, the distribution of phenotype conditional on genotype, the distribution of offspring genotypes conditional on parental genotypes, and the mode of sampling from the population. These components are described for particular cases of each model, and a general formulation of the likelihood presented in terms of them. The advantages and disadvantages of the two models are discussed, and it is seen that they are largely complementary with respect to power and robustness. A more general model that combines features of both these models is thus more useful than either, but even such a model can falsely indicate the presence of a major gene.

25179 **Genetic epidemiology: models of multifactorial inheritance and path analysis applied to qualitative traits.** Rice, J.P. (Washington Univ. School of Medicine, St. Louis, MO). pp 225-244 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Methods used in Genetic Epidemiology to model familial resemblance are described. Emphasis is given to qualitative traits in which affection is based on an underlying continuous liability scale on which affected individuals correspond to those with deviant scores. The Multifactorial Model, in which genetic and environmental factors act additively to determine liability, is parameterized in terms of the correlations in liability between relatives and prevalences in males and females. Path analysis is used to partition the liability distribution into components and resolve the sources of familial resemblance. Approaches to take into account ascertainment (sampling families through affected individuals) and variable age of onset are outlined. The incorporation of ancillary covariates in the analysis of family data is considered. Finally, broader issues relating the assumptions and methods of Genetic Epidemiology to those of other approaches in the study of chronic diseases are discussed.

25180 **Screening for cancer of the breast and cervix - estimating the duration of the detectable preclinical phase.** Day, N.E.; Walter, S.D. (International Agency for Research on Cancer, Lyon, France). pp 247-258 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Mass screening for breast and cervical cancer has been shown to be beneficial, reducing mortality from the disease in the former and both mortality and incidence in the latter. Models of the disease process and the effect of screening are helpful in estimating the benefits of alternative screening strategies, given the results from a particular screening program. Such models are described and emphasis is placed both on the design of case-control

studies to provide the information necessary for parameter estimation, and on case-control estimation procedures. Data are presented from screening programs for both types of cancer, with estimates of the various relevant parameters, and the implications for screening policies are discussed.

25181 **Statistical modeling and extrapolation of carcinogenesis data.** Krewski, D.; Murdoch, D.; Dewanji, A. (Health & Welfare Canada, Ottawa, Ontario). pp 259-282 of Modern statistical methods in chronic disease epidemiology: Proceedings. Moolgavkar, S.H.; Prentice, R.L. (eds.). New York, NY; John Wiley and Sons, Inc. (1986). (DOE/ER/60283—1; CONF-8506374—).

From 10. conference on modern statistical methods in chronic disease epidemiology; Alta, UT, USA (24 Jun 1985).

Mathematical models of carcinogenesis are reviewed, including pharmacokinetic models for metabolic activation of carcinogenic substances. Maximum likelihood procedures for fitting these models to epidemiological data are discussed, including situations where the time to tumor occurrence is unobservable. The plausibility of different possible shapes of the dose response curve at low doses is examined, and a robust method for linear extrapolation to low doses is proposed and applied to epidemiological data on radiation carcinogenesis.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 25080, 25160

25182 (LBL—22300, pp 11) **Increase in megakaryocyte size within ploidy groups and shift in ploidy in thrombocytopenic mice.** Ebbe, S.; Carpenter, D.; Yee, T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The fact that megakaryocyte ploidy increases in response to thrombocytopenia has been known from the work of others. The present results confirm the conclusion that the shift in ploidy distribution is a major mechanism responsible for macromegakaryocytosis in both acute and chronic immunothrombocytopenia. In addition, they also describe a second, previously unrecognized mechanism that regularly contributes to macrocytosis of megakaryocytes in prolonged immunothrombocytopenia, namely an increase of cell size out of proportion to ploidy.

25183 (LBL—22300, pp 51-60) **Inhibition by interleukin-1 of the action of erythropoietin of erythroid precursors and its possible role in the pathogenesis of hypoplastic anemias.** Schooley, J.C.; Kullgren, B.; Allison, A.C. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The objective of our research has been to define monocyte or macrophage-derived mediators that can suppress erythropoiesis and could therefore contribute to anemia associated with infection. Four glycoprotein products of activated human monocytes or macrophages have been sequenced and cloned: interferon-α (IFN-α), two varieties of IL-1 (IL-1α and IL-1β) and tumor necrosis factor α (TNF-α). We have found that both IL-1α and IL-1β inhibit the action of Ep on ERC in culture, whereas TNF-α and interferons have no demonstrable effect. Prostaglandins do not measurably contribute to the suppressive effect of IL-1. We therefore suggest that IL-1 may be a major mediator of the inhibition of erythropoiesis and in the discussion evidence supporting the view that IL-1 may be a common mediator of many types of hypoplastic anemia is presented. Inhibition of IL-1 production may explain the beneficial affects of glucocorticoid therapy in the Diamond-Blackfan syndome and anemia associated with giant-cell arteritis, and may be one factor in the favorable response to immunosuppressive therapy that can occur in hypoplastic anemias associated with T-lymphocyte activation. 49 refs., 3 figs., 4 tabs.

25184 (LBL—22300, pp 62-64) **Immunoreactive erythropoietin concentrations in neonatal rats and the effects of hypoxia.** Clemons, G.K.; Fitzsimmons, S.L.; DeManincor, D. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We attempted to find answers to what are the circulating, hepatic and renal erythropoietin (Ep) levels in normal rat neonates measured daily through the first three weeks of life and when they attain sexual maturity, how are these Ep levels altered by exposure to hypoxia, and whether can it be transferred to the nursing neonatal animals? Since we established earlier that in the fetal rat the liver is the main Ep producing tissue, we attempted to determine the age at which the switch from liver to kidney occurred in both the normal and the hypoxic neonatal rat. 2 figs.

5520 Public Health

REFER ALSO TO CITATION(S) 25165, 25166, 25167, 25168, 25169, 25170, 25171, 25172, 25173, 25174, 25175, 25176, 25177, 25178, 25179, 25180, 25181

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 24325, 25100

25185 **(IAEA-R—2973-F) Chromosome polymorphism in a population of ceratitis capitata. Final report for the period 1983 - 1987.** Lifschitz, E. (Instituto Nacional de Tecnologia Agropecuaria, Castelar (Argentina)). (International Atomic Energy Agency, Vienna (Austria)). Aug 1987. vp. NTIS (US Sales Only), PC Axx/MF A01. Order Number TI88701809/JAW.

A morphological chromosomal polymorphism along with the observation of B chromosomes in a natural population of Ceratitis capitata is reported. A variability affecting the centromere size of chromosome 3 is described. The observed B chromosome is minute, heterochromatic and telocentric. The B chromosome was found in the male and female germ cells and it exhibited, in the males, intra-individual numerical variation with OB and IB cells, which suggested a mitotic instability. It was also found, in both sexes, in somatic cells (cerebral ganglia tissue). Only males transmitted the B chromosomes to the progeny. The high rate of transmission suggested a differential utilization of the sperm carrying the B chromosomes or a preferential segregation into secondary spermatocytes. Previously reported linkage relationship between a pupal esterase gene (Est-1) and a pupa colour mutant (nig) has been extended to a line carrying a Y-chromosome (Y,B) shorter than the one previously studied (Y,A). Furthermore, an elaborate crossing scheme has been devised in order to estimate the recombination distances between these two genes and a third one affecting pupal length (lp-1). It is concluded that all three genes are in the same linkage group but Est-1 is far from the other two. In turn, nig and lp-1 are separated by 14.9 map units. It is confirmed that genetic recombination does not regularly occur at high frequency in the male and this frequency is not increased by the varying length of the Y-chromosome. Refs, figs, tabs.

25186 **(IAEA-R—3595-F) Induction and evaluation of useful mutants in cassava (Manihot esculenta) and yam (Diascorea sp.) by gamma radiation. Final report for the period November 1983 - February 1987.** Klu, G.Y.P. (Ghana Atomic Energy Commission, Accra). (International Atomic Energy Agency, Vienna (Austria)). Nov 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701810/JAW.

Stem cuttings of the cassava cultivar "Bosom" were irradiated with gamma rays. A dose of 5000 rad was lethal, but a dose of 3000 rad was found to allow sprouting of 50% of the buds. For tuber cuttings of yam, the LD50 was found to be around 2000 rad. 6 refs, 1 tab.

25187 **(IAEA-R—4196-F) Mutants induction in sweet potato by irradiation of Co/sup 60/ and selection, propagation, evaluation of desirable mutants. Final report for the period November 1985 - November 1986.** Lu Shuyun. (Beijing Agricultural Univ., BJ (China). Dept. of Agronomy). (International Atomic Energy Agency, Vienna (Austria)). Nov 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701812/JAW.

Cuttings of the sweet potato cultivar Xu-18 were exposed to gamma rays in 1983. This cultivar is susceptible to "sweet potato black rot" caused by Ceratocystis fimbriata E11. et Halst. and leading to serious post-harvest losses of tubers. The irradiated material was vegetatively propagated to M/sub 1/V/sub 3/. Mutant selection was undertaken on single plants in M/sub 1/V/sub 2/ and on clonal progenies in M/sub 1/V/sub 3/. Two promising clonal lines namely "12-11-8" and "09-56", possessing much better resistance to black rot than the original cultivar "Xu-18" were identified in 1985 and 1986. Their yield is comparable to the original cultivar. The mutant clones are now to be tested in different locations, where the disease is endemic. If the results of these tests are positive, the clones will be released as improved cultivars to the farmers. The experiment has been very successful and results of practical significance were obtained within the short period of only 4 years. 4 refs, 1 fig, 3 tabs.

25188 **(INIS-XN—6) Order of 17 May 1985 on treatment by ionizing radiation of gum-arabic, dehydrated vegetables and cereal flakes and seeds.** (International Atomic Energy Agency, Vienna (Austria)). 16 Jun 1985. 2p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780066/JAW.

Published in the Journal Officiel de la Republique Francaise of 16 June 1985.

This Order fixes the licensing conditions for the sale of gumarabic, dehydrated vegetables and cereal flakes and seeds for use in dairy products, whose microbial decontamination was obtained through exposure to cobalt 60 or caesium 137 gamma-rays or electron beams with an energy below or equal to 10 MeV.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

REFER ALSO TO CITATION(S) 25015, 25265

5601 Radiation Effects

REFER ALSO TO CITATION(S) 24840

25189 **(CONF-8703182—Summs.) DOE contractors' workshop: Cellular and molecular aspects of radiation induced DNA damage and repair.** (USDOE Office of Energy Research, Washington, DC. Office of Health and Environmental Research; Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). 1987. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88002817/JAW.

From Conference on cellular molecular aspects, radiation induced DNA damage and repair; Albuquerque, NM, USA (10 Mar 1987).

For four decades the US Department of Energy and its predecessors have been the lead federal agency in supporting radiation biology research. Over the years emphasis in this program has gradually shifted from dose-effect studies on animals to research on the effects of radiations of various qualities on cells and molecules. Mechanistic studies on the action of radiation at the subcellular level are few in number and there is a need for more research in this area if we are to gain a better understanding of how radiation affects living cells. The intent of this workshop was to bring together DOE contractors and grantees who are investigating the effects of radiation at the cellular and molecular levels. The aims were to foster the exchange of information on research projects and experimental results, promote collaborative research efforts, and obtain an overview of research currently supported by the Health Effects Research Division of the Office of Health and Environmental Research. The latter is needed by the Office for program planning purposes. This report on the workshop which took place in Albuquerque, New Mexico on March 10-11, 1987, includes an overview with future research recommendations, extended abstracts of the plenary presentations, shorter abstracts of each poster presentation, a workshop agenda and the names and addresses of the attendees.

25190 **(IC—86/399) Biophysical mechanism of cell inactivation by ionizing particles.** Lokajicek, M. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701856/JAW.

In radiobiological mechanism it is possible to distinguish the sequence of three different phases which can be denoted as physical, physico-chemical and biological. Mathematical models of the individual phases and their mutual interrelations are discussed. A special accent is given to the relation between the models of two non-biological phases and that of the biological one. Some detailed characteristics concerning DSB formation and repair and inactivation mechanisms in cells are analyzed with the help of the considered model chain. (author). 39 refs, 3 figs, 3 tabs.

25191 (INIS-mf—10576, pp 55) **Changes of diphenylhexatriene fluorescence and polarization in lymphocyte membranes after neutron irradiation.** Tatara, M.; Virsik, Z. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava, Czechoslovakia). 1985. NTIS (US Sales Only), PC A02/MF A01. Order Number DE87701460/JAW. (CONF-8504292—Absts.).

From 6. Czechoslovak biophysical congress with international participation; Bratislava, Czechoslovakia (10 Apr 1985).

25192 (INIS-mf—10576, pp 62) **Effect of combined treatment with platinum complexes and radiation on DNA in vitro.** Vrane, O.; Brabec, V. (Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav). 1985. NTIS (US Sales Only), PC A02/MF A01. Order Number DE87701460/JAW. (CONF-8504292—Absts.).

From 6. Czechoslovak biophysical congress with international participation; Bratislava, Czechoslovakia (10 Apr 1985).

25193 (INIS-mf—10576, pp 12) **Adrenaline action on / sup 89/Sr fluxes in isolated single muscle fibre of crayfish.** Castiglione, J.; Zacharova, D.; Sajter, V.; Lipskaja, E. (Komenskeho Univ., Bratislava, Czechoslovakia. Lekarska Fakulta; Slovenska Akademia Vied, Bratislava, Czechoslovakia). 1985. NTIS (US Sales Only), PC A02/MF A01. Order Number DE87701460/JAW. (CONF-8504292—Absts.).

From 6. Czechoslovak biophysical congress with international participation; Bratislava, Czechoslovakia (10 Apr 1985).

25194 **(INIS-mf—11642) Studies of the radioprotective properties of nicotinyl compounds, aspartic acid, glutamic acid and methionine.** Itzel-Kietzmann, V.M. (Tierarztliche Hochschule Hannover (Germany, F.R.)). 18 Dec 1986. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88752656/JAW.

Radioprotective properties of sodium salts of nicotinyl aspartic acid, nicotinyl methionyl aspartic acid and nicotinyl glutamic acid were tested in mice (NMRI). Experimental animals were irradiated by rayage (9,5 Gy). Parameters were: survival rate, peritoneal fluid cell count, weight and DNA concentration of spleen, hepatic DNA polymerase activity and rate of protein synthesis, lactate dehydrogenase activity in serum, maltase, sucrase and leucine aminopeptidase activitiy in duodenum and jejunum. Following results were obtained: 1. There was no significant difference in survival rate of treated and untreated animals. In treated animals only a short prolongation of survival time was observed. 2. After irradiation a quick reduction of splenic weight and DNA concentration was measured. 3. A reduction of DNA polymerase activity in liver was observed in treated and untreated mice. The rate of hepatic protein synthesis was similar in all animals. A final decrease was observed. 4. Variable activities of maltase, sucrase and leucine aminopeptidase activity in duodenum and jejunum indicated no radioprotective effect of tested substances. In conclusion of these results the tested substances show no significant radioprotective properties.

25195 **(INIS-XN—7) Decree No. 85-140 of 28 January 1985 on the Higher Council for Nuclear Safety.** (International Atomic Energy Agency, Vienna (Austria)). 31 Jan 1985. 1p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780067/JAW.

Published in Journal Officiel de la Republique Francaise.

The Council set up in 1973 under the supervision of the Minister responsible for energy matters, is charged with all questions dealing with nuclear safety. This Decree expands membership in the Council. (NEA)

25196 **(INIS-XN—9) Decree No. 85-968 of 27 August 1985 amending Section R 233-83 of the Labour Code and defining health and safety conditions to be met by gamma radiation industrial equipment.** (International Atomic Energy Agency, Vienna (Austria)). 14 Sep 1985. 3p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780069/JAW.

Published in the Journal Officiel de la Republique Francaise.

This Decree lays down the technical and other conditions to be complied with for operation of gamma radiation industrial equipment. (NEA)

25197 **(INIS-XN—27) Order No. 94 of 16th March 1982 concerning the use of X-ray equipment.** (International Atomic Energy Agency, Vienna (Austria)). 16 Mar 1983. 2p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780071/JAW.

This Order on the use of X-ray equipment, etc. lays down provisions on safety measures in connection with design, operation, notification and approval of equipment producting X-rays (published in Lovtidende for Kongeriget Danmark, Part A, 21st March 1982). The Order applies to equipment emitting X-rays, irrespective of the purpose of the equipment. The safety measures laid down in this Order are in accordance with the recommendations of the International Commission on Radiological Protection. This Order, which came into force on 1 April 1982, repeals Order No. 56 of 17 February 1977 on the use of X-ray equipment. (NEA)

25198 **(INIS-XN—28) Order No. 308 of 24th May 1984 on industrial gamma radiography.** (International Atomic Energy Agency, Vienna (Austria)). 24 May 1984. 13p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780072/JAW.

This Order was made in pursuance of Order No. 574 of 20 November 1975 on the safe use of radioactive substances and Directive No. 80/836 of the Council of the European Communities amending the Directives laying down basic radiation protection standards. It lays down specific requirements for the use of gamma radiography equipment. The Order which was published in Lovtidende for Kongeriget Danmark 1984, Part 2, 22 June 1984, came into force on 1 July 1984. (NEA)

25199 **(INIS-XN—29) Order No. 307 of 24th May 1984 on industrial X-ray equipment.** (International Atomic Energy Agency, Vienna (Austria)). 24 May 1984. 19p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780073/JAW.

This Order (published in Lovtidende for Kongeriget Danmark, 1984, Part A, 22 June 1984) was made in pursuance of Order No. 94 of 16 March 1982 and the Council of the European Communities' Directive No. 80/836 Euratom amending the Directives laying down basic safety standards. It lays down specific requirements concerning the use of X-ray equipment. The Order came into force on 1 July 1984. (NREA)

25200 **(INIS-XN—36) Act No. 15 amending the Radiation Protection Act.** (International Atomic Energy Agency, Vienna (Austria)). 10 Jan 1986. 1p. (In Finnish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE87780074/JAW.

This amendment to the Radiation Protection Act of 26 April 1957 (No. 174/57) provides that non ionizing electromagnetic radiation now falls within the scope of the Radiation Protection Act. Any plant or device emitting this type of radiation must be approved by the competent authority before it can be operated or sold. However, no safety permit is needed in their respect. The authority competent for implementing these regulations will be designated by decree; in all likelihood this will be the Radiation Protection Centre. (NEA)

25201 **(ISH—112) Biological indicators of radiation exposure - radiation-induced alterations of electrophoretic mobility of human erythrocytes.** Butkowskyj-Walkiw, T.; Spiegelberg, A.; Boegl, W. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Jun 1987. 59p. (In German). Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

The purpose of such research is to establish a reliable procedure which could provide a clear dose-effect relationship but would not impose an unnecessary burden on the exposed individuals. The present study has been intended to meet this requirement using easily accessible blood samples. Analysis was based on the radiation-induced change in the electric load of the erythrocytes. If cells are exposed to ionizing radiation, the resulting change in their surface charge will lead to a change in electrophoretic mobility (EPM). Thus, according to the results that have been published up to now, the erythrocytes' behaviour might be used to assess the absorbed dose of radiation. However, these results do not provide detailed information about the extent of the effect. This is due among others, to the measuring methods applied, some of which are associated with an important measuring error. In order to avoid this problem, free-flow electrophoresis was used. After in vitro irradiation of human erythrocytes at a dose of 3 Gy and subsequent fixation using KMnO/sub 4/, the electrophoretic behaviour of the cell membrane was found to change by a rate of up to 6%. In order to answer the question of whether this method would be suitable as a biochemical indicator, we conducted not only in vitro experiments but also experiments involving in vivo irradiation of human erythrocytes. For this purpose we collected blood from radiation therapy patients. The results of this study showed that electrophoretic changes by up to 6% may be observed within a period up to 2 days following exposure to ionizing radiation. The suitability of this biochemical indicator system for the detection of radiation is, however, complicated by variations in the EPM of non-irradiated erythrocytes.

25202 **(Juel—2133) Investigation of the effects of long-term infusion of /sup 125/I-iododeoxyuridine on tumor growth in mice (solid mouse tumor sarcoma-180).** Wirtz, F. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Medizin; Duesseldorf Univ. (Germany, F.R.)). May 1987. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752665/JAW.

The present experiments were designed to test the therapeutic qualification of /sup 125/I incorporated in DNA of tumor cells. The tumor-host system used was the solid mouse tumor sarcoma-180 growing on female albino mice (NMRI). A device was built which makes it possible to intravenously infuse tumor bearing mice with solutions of /sup 125/IUdR for several weeks. Three or, respectively, 5 days before the onset of the infusions the mice were inocculated into the right hind leg with 3x10/sup 5/ tumor cells in 0.1 ml physiological salt solution. The total activity administered per mouse was 100 μCi infused during a period of 10 days. After termination of the infusions tumor sizes and retained radioactivities were measured every 5 days until death of the animals occured. In comparison with tumors of control animals tumors of mice infused with /sup 125/IUdR showed a mean retardation in growth of about 27% of the volumes of control tumors during the total period of post-infusion observation (25 days). Extension of life expectancy and an increase of the rate of final tumor regression did not occur. Likewise, no significant differences were observed between tumors which were 3 or 5 days old on the first day of infusion. After termination of the infusions the residual whole-body radioactivity per mouse was about 1% of the total activity infused per animal. This was in good agreement with calculations considering rates of incorporation and excretion and confirmed earlier assumptions that only about 5% of the administered IUdR is incorporated initially. The number further confirmed that, during the first 10 days after incorporation, the daily loss of activity - due to cell death - is about 30%. Control animals without tumors showed a faster decrease of

incorporated activity or, respectively, loss of cells than tumor bearing mice. (Abstract Truncated)

25203 **(KFK—4181) Alterations in radioresistance of eucaryotic cells after the transfer of genomic wildtype DNA and metallothionein genes.** Lohrer, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Genetik und Toxikologie von Spaltstoffen; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Bio- und Geowissenschaften). Jan 1987. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88752672/JAW.

The presented paper describes experiments concerning the alteration of radiosensitivity of eucaryotic cells after gene transfer. Ionizing radiation (γ- or X-ray) induces DNA single- or double strand breaks, which are religated by an unknown repair system. Repair deficient cells are highly sensitive to ionizing radiation. In the experiments described, cells from a patient with the heritable disease Ataxia telangiectasia were used as well as two X-ray sensitive CHO mutant cell lines. After gene transfer of an intact human DNA repair gene or a metallothionein gene the cells should regain radioresistance.

25204 (LBL—22300, pp 60-62) **One type of pluripotential hemopoietic stem cells provides permanent, another temporary bone marrow repopulation.** Brecher, G. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The permanent repopulation of the marrow of lethally irradiated mice by single donor stem cells was demonstrated. The incidence of these cells in donor marrow is of the order of 1 in 50,000. Transfusion of 10 and 20,000 marrow cells are also capable of ensuring the recovery of about 20% of lethally irradiated mice. Donor cells temporarily repopulate the host marrow and enable the irradiated host cells to maintain the animal indefinitely. The transfused donor stem cells are not capable of permanent repopulation of the host because their self-renewal is limited. The two types of pluripotential stem cells are referred to as type A and B, following Micklem who predicted their existence.

25205 (LBL—22300, pp 78-86) **Initial distribution of neptunium-237 in a monkey.** Durbin, P.W.; Jeung, N.; Bucher, J.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

This pilot study of the initial distribution of ^{237}Np(V,IV) in an adult Macaque monkey was undertaken to begin upgrading the biological data for Np using an animal phylogenetically close to man, to demonstrate that it was possible to measure small amounts of ^{237}Np in biological samples accurately by means of its photon emission, and to provide detailed initial distribution data on soft tissues and within the skeleton for an actinide element with a stable (V) state, for comparison with similar data we have obtained for ^{90}Sr(II), ^{241}Am(III), ^{238}Pu(IV), and ^{233}U(IV) in adult Macaques. 22 refs., 1 fig., 5 tabs.

25206 (LBL—22300, pp 87-92) **New sequestering agents for the actinides: Removal of plutonium-238 from mice by orally administered ligands.** Durbin, P.W.; Jeung, N.; Weitl, F.L.; White, D.L.; Turowski, P.; Raymond, K.N.; Schmidt, C.T. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The purpose of this program is to provide biological data needed to guide the design of safe and effective chelating agents for actinides and chemically similar elements. Macromolecules have been synthesized containing multiple catechoylamide (CAM), hydroxamate (X), hydroxypyridinone (HOPO) and carboxyl (C) functional groups, either all with the same functional groups [e.g., the tetrameric carboxycatechoylamide, 3,4,3-LICAM(C)] or with different functional groups (e.g., DFO-HOPO, which contains three hydroxamate and one hydroxypyridinone groups). All of those functional groups in a variety of molecular arrangements, form remarkably stable complexes with Pu(IV) and Fe(III) at pH 7.4, and when administered by parenteral injection, promote significant excretion of circulating Pu(IV) in mice and dogs. This report presents the results of a preliminary test of the oral effectiveness of several representative new ligands for promoting excretion of circulating Pu(IV) from mice. 13 refs., 2 tabs.

25207 (LBL—22300, pp 95-98) **Influence of DNA structure in chemical reactions with hydroxyl radicals.** Chatterjee, A.; Koehl, P.; Magee, J.L.; Holley, W.R. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

From our calculation it is clear that the secondary and tertiary structures of a polymer play a significant role in influencing the rate constant of reactions. For reaction of OH with a monomer unit in a polymer is smaller than that of OH with the same unit when in isolation. The reason for such a reduction is that the monomer unit in the polymer is shielded by other units in the polymer and hence there is an overall reduction in the reaction possibilities. 7 refs., 2 figs., 1 tab.

25208 (LBL—22300, pp 98-100) **LET dependence of cross sections for DNA strand breaks by direct effects of charged particles.** Holley, W.; Chatterjee, A.; Magee, J.L. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

In the theoretical studies described here the effects of the direct deposition of energy from the core or penumbra of a fast charged particle onto a DNA molecule in dilute aqueous solution is considered. The actual physical energy deposition processes are statistical in nature. We use stopping power formulas to calculate the average energy absorption of DNA, and Poisson statistics to obtain a detailed description of the resulting states of excitation of the molecule. The average energy of an excitation (ionization) is not known for molecules like nucleic acids or DNA, but 30 eV, a reasonable figure obtained from arguments about the absorption spectrum of water is used. Excitation of the DNA molecule is most likely followed by one of two different types of dissociation, deprotonation or direct dissociation, both of which may lead to DNA strand breaks. 2 figs.

25209 (LBL—22300, pp 107-109) **Cell cycle dependent x ray OER: Role of endogeneous glutathione.** Blakely, E.A.; Roots, R.J.; Chang, P.Y.; Lommel, L.; Craise, L.M.; Goodwin, E.H.; Yee, E. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

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We have examined the possible variation in aerobic and hypoxic radiosensitivity during the cell division cycle. 10 refs., 3 figs., 1 tab.

25210 (LBL—22300, pp 109-111) **Lesions in CHO chromatin produced by very high LET heavy ions.** Goodwin, E.H.; Blakely, E.A.; Tobias, C.A. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Despite the much higher LET of the uranium ion beam there is a qualitative similarity between the niobium and uranium-induced lesion distributions. This similarity is primarily due to the biological structure of the cell nucleus, i.e., the ion crosses chromatin from 6 to 12 times with a high probability of producing a lesion at each crossing. Both the niobium and uranium distributions have a few cells with a small number of lesions (from 1 to 5 per cell). These lightly damaged cells were probably hit by energetic electrons in the penumbra of one or more particle tracks but were spared a direct hit by a more damaging track core. The reason that there are more of these lightly damaged cells in the uranium distribution could be due to the longer range of energetic electrons in the penumbra of tracks produced by the faster moving uranium ions. On a per rad basis the uranium beam is much less effective than the niobium beam in the production of chromatin breaks. This is expected since, at a higher LET, there are fewer uranium particles per rad compared to niobium. 6 refs., 1 fig.

25211 (LBL—22300, pp 112-114) **DNA lesions in cell nuclei follow Neyman A distribution.** Tobias, C.A.; Goodwin, E.H.; Blakely, E.A. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We have investigated the number and distribution of radiolesions produced by x rays and accelerated atomic nuclei in mammalian cells. This is a difficult task because the initial lesions in DNA are usually of atomic dimensions. During most of the cell division cycle, we cannot observe DNA in the cell nucleus without killing the cells and highly denaturing the genetic material. Premature chromosome condensation make chromatin lesions visible. By use of these lesions are produced in a random Poisson distribution after doses of x rays, but exposures to accelerated heavy ions result in distributions of lesions that were very different from Poisson. 4 refs., 4 figs.

25212 (LBL—22300, pp 114-115) **Radiosensitization produced by iododeoxyuridine in heavy ion beams.** Linstadt, D.E.; Blakely, E.A.; Phillips, T.L.; Castro, J.R.; Chang, P.Y.; Lommel, L. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

This study showed that repair of potentially lethal damage from neon ions was less than that measured after comparable x-ray doses, but there was no difference in the magnitude of potentially lethal damage repair with or without iododeoxyuridine (IUDR). These results suggest that IUDR sensitizes primarily by increasing the amount of alpha-type damage ("single hit killing") and agrees with the current hypothesis that sensitization results from the cation of localized regions of heavy DNA damage. These results also suggest that IUDR is likely to function effectively as a sensitizer in fractional radiotherapy regimens utilizing either photons or clinically useful heavy-ion beams, particularly where a tumor might exist in a substrate of normal tissues which would have slower turnover than the tumor. 2 figs.

25213 (LBL—22300, pp 116-117) **The importance of triggering dose and conditions of split dose incubation to the development of thermotolerance.** Chang, P.Y.; Blakely, E.A. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

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We have observed a lack of development of thermotolerance in CHO-TSH1, a protein synthetic mutant hamster cell line, under continuous heat stress treatments of 41.5°C, 42°C, and 42.5°C. The parental CHO-SC1 line develops thermotolerance under similar conditions. During the past year we have further examined this phenomenon in the mutant by studying the role of the level of the triggering heat dose and the time of administration to the ultimate development of thermotolerance. By increasing the temperature of the triggering dose for a brief interval, followed by the time at the permissive temperature, we were able to induce the development of thermotolerance in the protein-synthetic mutant cell. 4 refs., 2 figs.

25214 (LBL—22300, pp 117-125) **Dose protraction studies with low and high LET radiations on neoplastic cell transformation in vitro.** Yang, Tracy Chui-hsu; Craise, L.M.; Mei, Man-tong; Tobias, C.A.;. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

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Because human occupational exposure in a space environment and on earth is usually at a low does rate, it is important to understand the low-dose-rate effects of high-LET radiation for risk assessment. Accelerated heavy ions of different energy and atomic number provide valuable tools for examining the dose-rate effects with various LET and track structure. Using mouse embryonic cells we earlier investigated the frequency of radiation-induced cell transformation with x rays and energetic heavy ions at high dose rates and found that heavy ions enhanced the frequency of cell transformation more than x rays did. The primary objective of the present study is to determine whether low- or high-LET radiation can further enhance the neoplastic cell transformation at low dose rates and to uncover the role of the LET of heavy ions in the enhancement effect. 28 refs., 8 figs., 2 tabs.

25215 (LBL—22300, pp 126-127) **Induction of thymidine-kinase gene mutation in mammalian cells by low- and high-LET radiation.** Yang, Tracy Chui-hsu; Perez, C.F.; Mei, Man-tong; Craise, L.M.; Tobias, C.A. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

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We examined the effectiveness of x rays and heavy ions in inducing thymidine-kinase TK^- deficient mutants in H1D cells. The RBE for iron particles was about 5.2 and 3.0 at 50% and 10% survival level respectively. For x rays the LD_{50} was about 300 rad, and the LD_{10} about 600 rad. The dose-response curve for TK^- mutation was curvilinear for both x rays and iron beam. The RBE for iron particles was about 3 at high doses for mutation. These data suggest that for an equal dose energetic iron articles can be much more effective than x rays in inducing somatic mutation. When the mutation frequency was compared at equal survival level, however, there was no significant difference between x rays and iron beam. The number of mutants per survivor as a function of the logarithm of the survival ratio shows an approximately linear relationship. 4 figs.

25216 (LBL—22300, pp 127-130) **Effects of high energy uranium particles on somatic cell mutation and DNA transfection.** Yang, T.C.; Craise, L.M.; Kraft, G.; Tobias, C.A. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

These results showed that high energy uranium particles induce irrepairable lethal and $HGPRT^-$ mutation lesions and repairable enhancement damage, and that DMSO can reduce the formation of lethal and enhancement lesions but not $HGPRT^-$ mutation injury. 3 refs., 5 figs.

25217 (LBL—22300, pp 130-131) **The sandwich system as a tumor analog.** Hlatky, L.; Alpen, E.L. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Our studies using the sandwich system consists of developing the system as a tumor analogue; characterizing the diffusion limitations and cell kinetics of the system; using the system in radiation experiments; analyzing the effect of varying the oxygen and glucose concentrations in the system; and developing an oxygen-glucose model for growth and necrosis and applying it to the system.

25218 (LBL—22300, pp 132-135) **Tumor radiobiology studies with heavy charged particle beams.** Afzal, S.M.J.; Tenforde, T.S.; Kavanau, K.; Curtis, S.B. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We have previously reported measurements of clonogenic cell survival in R-1 rat rhabdomyosarcoma tumors of the R2C5 subline following in situ irridation with 225-kVp x rays or with 557-MeV/u neon ions in the distal position of a 4-cm extended-peak ionization region. X ray and neon ion were shown to reduced the initial surviving fraction to 0.025. Significant 5-fold and 10-fold decreases in the fraction of clonogenic cells were observed between 3 and 4 days after irradiation with peak neon ions and x rays, respectively. These results represent the first time that a delayed decrease of this magnitude in postirradiation cell survival has been observed for a rat rhabdomyosarcoma tumor line. Several factors related to tumor-host interactions and the tumor cell environment following large doses of radiation are considered in an attempt to explain significant decrease in clonogenic cell survival. 4 figs.

25219 (LBL—22300, pp 135-137) **Comparison of damage and recovery in quiescent rat lens cells following irradiation with HZE particles and x rays.** Riley, E.F.; Lindgren, A.L.; Ainsworth, E.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We are using an in vivo stimulus-response test system to quantitatively compare the biological effects of accelerated Fe ions with those from x rays and to monitor the slow recovery of quiescent (G_0) epithelial cells over an extended period of time. 4 refs., 3 figs.

25220 (LBL—22300, pp 137-140) **Response of mouse marrow stem cells (CFU-S) to heavy charged particles.** Ainsworth, E.J.; Prioleau, J.C.; Mahlmann, L.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

It was established earlier that CFU-S content and radiosensitivity could be correlated with animal radiosensitivity to hematopoietic death. It was also determined that femur CFU-S content did not correlate with LD/sub 50/30/ when marrow perturbed by previous irradiation was in a regenerative phase following a single dose of radiation. This indicates that the radiosensitivity of the animal is determined by a more primitive cells than the CFU-S. Recent studies stressed the importance of CFU-S subpopulations that are assessed indirectly by expression of spleen colonies at times ranging between 8 and 13 days following marrow transplantation. Interest in sustained alterations in hematopoietic control systems relates to the fundamental aspects of regulation of proliferative systems as well as to mechanisms of alterations in relation to neoplastic diseases originating within the hematopoietic system. The status of our current program on CFU-S responses to charged particle radiation is that studies on inactivation as a function of particle charge, velocity and LET are nearly completed, and future studies will focus on triggering CFU-S into cycle, on radioprotective drugs, and on mechanisms by which late alterations in the size of the CFU-S population are produced by ionizing radiations. 13 refs., 3 figs.

25221 (LBL—22300, pp 140-142) **The relative biological effectiveness of 670 MeV/A neon as a function of depth in water for a tissue model.** Schimmerling, W.; Alpen, E.L.; Powers-Risius, P.; Wong, M.; Rapkin, M. Apr 1987. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE87009280/JAW.

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These studies show RBE/sub ave/ as a function of depth in water. The maximum RBE is obtained near the Bragg curve and has a value of 1.66. The results can be used to predict the relative biological effectiveness in arbitrary beams, when the absolute particle fluences can be calculated, and to interpret the results of radiobiological experiments performed at any value of the water thickness along the Bragg curve of 670-MeV/A neon ions used in the last several years of research at the Lawrence Berkeley Laboratory Bevalac Biomedical Facility. The results should also be directly applicable to treatment planning in clinical applications of high energy heavy-ion beams. 1 ref., 3 figs.

25222 (LBL—22300, pp 142-145) **Neon irradiation of the rat spinal cord.** Rodriguez, A.; Alpen, E.L.; DeGuzman, R.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We will obtain RBE estimates and alpha:beta ratios for the induction of heavy ion-radiation myelopathy in the rat after single doses and multiple fractions. We are examining the hypothesis that the multifraction linear-quadratic model predicts a higher relative biological effectiveness (RBE) for late tissue damage and a higher alpha-beta ratio after heavy-ion irradiation. We will also determine the repair potential of the spinal cord after fractionated doses of neon ions (670 MeV) in the plateau region of ionization. 5 refs., 4 figs., 1 tab.

25223 (LBL—22300, pp 145-147) **Induction of Harderian gland tumors in mice by heavy ion irradiation.** Alpen, E.L.; Powers-Risius, P.; Fry, R.J.M.; Ainsworth, J.; De Guzman, R.J.; Havens, V.; Kavanau, K. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

Iu Biology and Medicine Division: Annual report 1986.

Using the mouse Harderian gland system, we have accumulated data on the relative biological effectiveness for tumor induction by cobalt, helium, carbon, neon, argon, and iron beams. Risk estimates for tumor induction by heavy ions have become important with the advent of heavy-ion radiotherapy and also with the likelihood of an increase in the number of persons in space where exposures to heavy ions can occur. Equally important is the value of these data in setting RBE values in carcinogenesis for high-linear-energy-transfer radiations in general. 4 refs., 2 figs., 2 tabs.

25224 (LBL—22300, pp 148-152) **Life shortening effects of heavy charged particles and photons.** Ainsworth, E.J.; Prioleau, J.C.; Mahlmann, L.J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

A series of "range finding" experiments were conducted with various particles where the singular endpoint would be life-span shortening. Comparisons with life-shortening data published earlier for fission-spectrum neutrons would yield significant new information regarding the risk of carcinogenesis after exposure to heavy particles and provide at least some limited insight regarding Q values. Additionally, pilot life-span studies over a range of LETs would provide information essential for the design of future low-dose studies in which collection of tumor dose-response data would be the primary goal. 10 refs., 3 figs.

25225 (NIRS-M—62) **Comparative aspects of animal and human data on somatic effects of ionizing radiation.** Matsuoka, Osamu; Kobayashi, Sadayoshi (eds.). (National Inst. of Radiological Sciences, Chiba (Japan)). Oct 1986. 257p. (In Japanese). (CONF-8512145—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88752348/JAW.

From 17. NIRS symposium; Chiba, Japan (11 Dec 1985).

This report contains presentations at the 17th Symposium organized by the National Institute of Radiological Sciences, which took place in Chiba, Japan, from 11 to 12 December 1985. Unlike in the previous symposiums dealing with cellular and molecular levels, the present symposium discussed somatic effects of ionizing radiation at the organic level in conjunction with epidemiological data. This report is divided into five sections: the first is explanation for UNSCEAR's and ICRP's views of human and animal data in the current assessment of radiation health risks; the second covers comparison of epidemiological and animal experimental data on the dose-effect relationship for carcinogenesis, together with problems in epidemiological and experimental studies; the third discusses significance and problems in animal experiments on modifying factors of radiation carcinogenesis; the fourth deals with studies on carcinogenesis mechanism, aiming at elucidating their significance and potential role in the risk evaluation for humans; and the last section is a compilation of panel discussion of differences in humans and animals, giving a proposal for future research. (Namekawa, K.).

25226 (OH—83-383-K) **Tritium oxide uptake and desorption kinetics in a primary producer: chlorella pyrenoidosa.** Dunstall, T.G. (Ontario Hydro Research Lab., Toronto (Canada)). 30 Dec 1983. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701951/JAW.

The alga Chlorella pyrenoidosa grown in batch culture under chronic tritium oxide exposure was used to model behavior of tritium at the primary producer level of an aquatic food chain. The specific activity ratio of organically bound tritium to medium tritium increased during initial growth stages, then reached an asymptotic steady state value of 0.59 after approximately seven cell doublings. The intracellular to extracellular concentrations of tritium oxide appeared to be in equilibrium. Loss of previously formed organically bound tritium in cells transferred to tritium-free media averaged less than 5 % for exponential growth phase cultures which had undergone more than three cell doublings. Over a comparable time period, a greater loss of organically bound tritium from stationary cells (average 13.4 %) was attributed to increased degradative metabolism in senescent cultures. Concentration of tritium in organically bound form may exceed environmental tritium oxide levels under dynamic conditions in which a pulse of tritium oxide to the environment is dissipated over time.

25227 (OH—84-69-K) **Tritiated water uptake kinetics in tissue-free water and organically-bound fractions of tomato plants.** Spencer, F.S. (Ontario Hydro Research Lab., Toronto (Canada)). Mar 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701958/JAW.

The kinetics of tritiated water (HTO) vapour uptake into tissue-free water tritium (TFWT) and organically bound tritium (OBT) fractions of tomato, Lycopersicon esculentum Mill., cv Vendor, were investigated under controlled growing conditions. Most uptake data fitted a first-order kinetic model, C/sub t/ = C/

sub ∞/ (1-e/sup -kt/), where C/sub t/ is the tritium concentration at time t, Ca the steady-state concentration and k the uptake rate constant. During atmospheric-HTO exposure with clean-water irrigation in open pots the TFWT k values were 0.024 +- 0.023 h/sup -1/ for new foliage, 0.104 +- 0.067 h/sup -1/ for old foliage and 0.042 +- to 0.136 h/sup -1/ for new green fruit. OBT uptake rate constants were 20 percent less for new foliage and 76 percent less for new green fruit. Under steady-state conditions the ratio of tritium specific activities of TWFT to atmospheric HTO were 0.43 in new foliage, 0.46 in old foliage and 0.19 in green fruit. Within the plant, OBT and TFWT ratios were 0.70 for new foliage, 0.63 for old foliage (maximum) and between 0.72 and 1.92 for green fruit. The greater than unity tritium specific activity ratios in green fruit were not attributed to tritium enrichment but rather to the translocation of foliar OBT to the growing fruit which contained lower specific activity TFWT derived from soil water.

25228 (PNL-SA—14432) Dosimetry of the gastrointestinal tract. Sullivan, M.F.; Cross, F.T.; Dagle, G.E. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 24p. (CONF-861123—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005174/JAW.

From CEC/CEA international workshop on age-related factors in radionuclide metabolism and dosimetry; Angers, France (26 Nov 1986).

In order to obtain information on radiation doses to the intestine, doses were determined in dogs for beta-emitters that might be delivered to critical cells in the bowel in the event of an accident. Thermoluminescent dosimeters were implanted beneath the large-bowel mucosa of dogs that had ingested ^{106}Ru-^{106}Rh (1.4 MeV anti E/sub β/). Results were related to toxicity in the dogs and extrapolated to toxicity observed in other experiments with suckling, weanling and adult rats similarly treated. That information enabled us to calculate the depth of the critical cells in both dogs and rats. Further studies, in rats, with a weak beta-emitter, ^{147}Pm, and an intermediate-energy beta-emitter, ^{91}Y, supported that extrapolation. The doses delivered to target cells differed from the doses calculated at the mucosal surface of the large bowel by a factor of as much as 50, depending on the beta-emitter ingested. In the neonatal rats, death resulted from damage to cells within the mucosa of the small bowel, demonstrating that these animals were more sensitive to intestinal irradiation from ^{106}Ru-^{106}Rh, on a body-weight basis, than weanlings or adult rats. Studies with isotopes, of thorium, uranium, protactinium, neptunium, plutonium, americium, curium, and einsteinium showed that substantial amounts of these alpha-emitting actinides were retained in the intestines of neonatal rats, guinea pigs, dogs, and swine after gavage. 26 refs., 7 figs.

25229 (RERF-TR—1-86) Life span study report 10 - 1. Cancer mortality among A-bomb survivors in Hiroshima and Nagasaki, 1950 - 82. Preston, D.L.; Kato, Hiroo; Kopecky, K.J.; Fujita, Shoichiro. (Radiation Effects Research Foundation, Hiroshima (Japan)). Aug 1987. 89p. (In Japanese and English). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88752321/JAW.

The present study extends the previous report on cancer mortality among atomic bomb survivors by adding data from four additional years of follow-up (1979 - 82) and by expanding the cohort (now designated LSS-E85) to include 11,393 Nagasaki survivors located between 2,500 - 9,999 m from the hypocenter at the time of the bombing (ATB). Significant dose responses were observed for leukemia, for cancers of the lung, female breast, stomach, colon, esophagus, and urinary bladder, and for multiple myeloma. Four new categories of cancer were also investigated: the results for cancers of the liver and intrahepatic bile ducts and of the ovary and other uterine adnexa were suggestive of significant radiation effects, but the positive dose responses for cancers of the gall bladder and prostate were not significant. Due to diagnostic difficulties and the lack of evidence for radiogenic effects at these sites, the results for liver and ovarian cancers do not provide convincing evidence for radiogenic effects. With the exception of multiple myeloma, the relative risk (RR) of radiation-induced cancer mortality was greater for women than for men, for each nonleukemic cancer with a significant overall dose response. These differences can be attributed in large measure to differences in the background cancer mortality rates, which are generally much higher for men than women. For leukemia there was no significant sex difference in the RR, while for multiple myeloma women had a slightly, though nonsignificantly, lower RR than males. A statistically significant interaction ($p = .008$) between the effects of age ATB and attained age on radiation-related mortality was also observed for cancers other than leukemia. In particular, the initially large RRs seen in those who were young ATB have decreased with time, while the smaller RRs for those who were older ATB tended to increase.

25230 (RERF-TR—9-87) Effect of changes in dosimetry on cancer mortality risk estimates in the atomic bomb survivors. Preston, D.L.; Pierce, D.A. (Radiation Effects Research Foundation, Hiroshima (Japan)). Aug 1987. 50p. (In English and Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752295/JAW.

In the spring of 1986, RERF received a new dosimetry system which was developed by the US-Japan Committee for Reassessment of Atomic Bomb Radiation Dosimetry in Hiroshima and Nagasaki. This report presents the comparisons of leukemia and nonleukemia cancer mortality risk estimates under the old and new dosimetries. In terms of total kerma (essentially whole-body gamma-ray plus neutron exposure), the risk estimates for both types of cancer are 75 %-85 % higher with the new dosimetry. This and other summary comparisons here make some allowance for possible nonlinearity at high estimated doses. It is also important to consider the changes in relation to organ doses and assumptions about the relative biological effectiveness (RBE) of neutrons. Without regard to RBE, the risk estimates for total organ dose are essentially unchanged by the dosimetry revision. However, with increasing assumed values of RBE, the estimated low-LET risk decreases much less rapidly under the new dosimetry, due to the smaller neutron component. Thus at an assumed constant RBE of 10, for example, the effect of the dosimetry revision is to increase organ dose risk estimates, relative to those based on the old dosimetry, by 30 % for nonleukemia and 80 % for leukemia. At an RBE of 20 these increases are 72 % and 136 %, respectively. A number of other issues are discussed. The city difference in dose-response is smaller with the new dosimetry, and is no longer statistically significant, even at an RBE of one. Estimation of RBE is even less feasible with the new dosimetry. There is substantial question of the linearity in dose-response, in the sense of a leveling off at higher doses. Finally, some indication is given of how estimated lifetime risks from this dosimetry may compare to widely-used estimates based largely on the RERF data with the previous dosimetry.

25231 (RERF-TR—12-86) Lung cancer incidence among A-bomb survivors in Hiroshima and Nagasaki, 1950 - 80. Yamamoto, Tsutomu; Kopecky, K.J.; Fujikura, Toshio; Tokuoka, Shoji; Monzen, Tetsuo; Nishimori, Issei; Nakashima, Eiji; Kato, Hiroo. (Radiation Effects Research Foundation, Hiroshima (Japan)). May 1987. 21p. (In English and Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752297/JAW.

The incidence of lung cancer during 1950 - 80 in a cohort of Japanese atomic bomb survivors and controls was investigated. A total of 1,057 cases were identified; 608 of these diagnoses were based on some form of histopathologic examination, and 442 were confirmed by the present investigators. The distributions of histological types varied significantly between the sexes ($p < .001$), with adenocarcinoma more frequent among women and epidermoid and small cell carcinoma more frequent among men. The distributions of primary sites did not differ significantly between the sexes. The relative risk (RR) of lung cancer increased significantly with A-bomb radiation dose ($p < .0001$); based on tentative 1965 dose estimates as revised in 1978 (T65DR) and a linear RR model, the estimated RR at 100 rad (+- SE) is 1.41 +- 0.09. Among Hiroshima survivors the women experienced radiation-related excess RR nearly twice as great as men ($p = .06$). RR increased with decreasing age at the time of bombing ($p = .07$), and after allowing for this effect, there was no significant evidence that RR varied systematically with attained age. Small cell carcinoma displayed somewhat greater sensitivity to radiation than did adenocarcinoma or epidermoid carcinoma; however the variation between the histology-specific RR functions was not statistically significant ($p = .44$).

25232 (RERF-TR—16-86) Medical X-ray exposure doses as possible contaminants of atomic bomb doses. Yamamoto, Osamu; Antoku, Shigetoshi; Russell, W.J.; Fujita, Shoichiro; Sawada, Shozo. (Radiation Effects Research Foundation, Hiroshima (Japan)). Aug 1987. 20p. (In Japanese and English). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752323/JAW.

Since 1964, at the times of their biennial ABCC/RERF radiological examinations, all Adult Health Study (AHS) subjects have been interviewed for their exposures to medical X-ray in institutions other than RERF to estimate the numbers of examinations and corresponding doses to which they were exposed. The doses incurred at RERF were assessed by means of phantom dosimetry. Those at other institutions were studied by incorporating numerous factors, including phantom dosimetry data, and results of several surveys for radiological trends in Hiroshima and Nagasaki. For A-bomb exposed groups and control groups (not-in-the cities), average marrow doses per person were 1,204 mrad and 892 mrad; male gonad doses were 226 mrad and 189 mrad; and female gonad doses were 1,745 mrad and 1,258 mrad respectively, by the end of 1982. The results for Hiroshima and Nagasaki were similar. Sixty-five percent of male subjects' medical X-ray bone marrow doses ranged from 10 % to 250 % of their T65 doses in the 1 - 9 rad T65 dose group. Thirteen percent of male subjects' medical X-ray bone marrow doses ranged from 10 %-250 % of their T65 doses in the 10 - 99 rad T65 dose group. In the greater than 100 rad T65 dose group, medical X-ray exposures were proportionally less. Female bone marrow and gonad doses were similar in magnitude to the male bone marrow doses. Medical X-ray exposures affected male gonal doses less than those of females, but in the 1 - 9 rad dose group, 18 % of male subjects' medical X-ray gonad doses ranged from 10 %-100 % of their T65 doses.

25233 (RERF-TR—19-85) Para-acetabular peritendinitis calcarea; its radiographic manifestations. Kawashima, Akira; Murayama, Sadayuki; Ohuchida, Toshiyuki; Russell, W.J. (Radiation Effects Research Foundation, Hiroshima (Japan)). Feb 1987. 24p. (In English and Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752298/JAW.

Peritendinitis calcarea and os acetabuli have long been confused during interpretations of hip-joint radiographs. Such confusion is reflected in the medical literature. The present study differentiated these two entities according to their interval radiographic progression and regression. There were 137 instances of para-acetabular calcifications among 110 subjects (59 men and 51 women), whose mean age was 46.8 years at the time of their initial detection. Twenty-six of the subjects had lumbago, which was probably unrelated. Other abnormalities including narrowed intervertebral spaces, scoliosis, and spondylolysis were observed in 21 of the subjects. These could have been responsible for any symptoms they had had, but none of the subjects complained of local hip-joint pain when the radiographs in question were made. Ninety-three of these instances of calcification were reviewed by means of serial radiographs. Interval changes in the sizes and shapes of the calcifications occurred among 90 of them, indicative of the latent type of peritendinitis calcarea. No interval changes were noted in the remaining three cases, indicating they were secondary ossification centers; namely, os acetabuli. This study showed that in asymptomatic adults, most para-acetabular calcifications were really not os acetabuli, but actually peritendinitis calcarea.

25234 (UCID—21302) Description of LLNL AERIN code revision to include ICRP30 concepts. King, W.C. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1987. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005882/JAW.

The AERIN code was written in 1976 at the Lawrence Livermore National Laboratory to calculate the internal dose to several organs of the body resulting from inhalation of transuranic radioactive materials. A major revision of the code was made in 1982 to incorporate the concepts of ICRP30 and to expand the model to include additional body organs. The code was compiled to run on a CDC7600 computer. In 1987 the code was revised in order that it could be compiled to run on a CRAY-1 computer. This document will describe the AERIN code as it exists now. The current version of the code will compute the time transport of a radioisotope from an initial site of deposition through the various organs of the body and calculate the dose equivalent to those organs using the ICRP30 concepts. The model described by the code can be used to study inhalation, ingestion and wounds either singly or in any combination of depositions. 5 refs., 3 figs.

25235 Base-specific damage induced by 4-thiouridine photosensitization with 334-nm radiation in M13 phage DNA. Ito, A.; Peak, J.G.; Peak, M.J.; Robb, F.T. (Argonne National Lab., Evanston, IL (USA); National Inst. of Arthritis, Metabolism, and Digestive Diseases, Bethesda, MD (USA)). *Photochemistry and Photobiology;* **47**: No. 2, 231-240(Feb 1988).

Site-specific DNA damage caused by 334-nm radiation in the presence of the rare Escherichia coli base 4-thiouridine was investigated in vitro by detecting the sites of the termination of DNA synthesis with irradiated M13 phage DNA used as a template. Single-strand breakage was also examined. The results indicate that 334-nm radiation at very low fluences in the presence of 4-thiouridine induces termination of strand synthesis at thymine base sites and at the base immediately prior to thymine. Termination at these sites was diminished by treatment with hot piperidine. Strand cleavage by piperidine treatments was observed preferentially at the guanine site, but only after irradiation at much larger fluences. It is hypothesized that at low fluences 4-thiouridine forms photoadducts with thymine that block DNA synthesis, while at high fluences the guanine site is damaged via oxygen species.

25236 Effects of the ultraviolet wavelengths of radiation present in sunlight on human cells in vitro. Coohill, T.P.; Peak, M.J.; Peak, J.G. (Western Kentucky Univ., Bowling Green (USA); Argonne National Lab., IL (USA)). *Photochemistry and Photobiology;* **46**: No. 6, 1043-1050(Dec 1987).

A review is given of the literature from January 1986 to July 1987 on the effects of the ultraviolet wavelengths of radiation present in sunlight on human cells in vitro. Topics covered include a comparison of the cell strains and radiation sources used in different studies, Cell death, mutagenesis, photoproduct formation in DNA including pyrimidine photoproducts, DNA backbone breaks and DNA-to-protein crosslinks, repair of solar UV-induced DNA photoproducts, the mechanism of induction of DNA damage by solar UV and finally the effects of ultraviolet radiation on the human epidermis. (U.K.).

25237 Sensitivity to X-irradiation in relation to cell size of CHO cells synchronized in early G/sub 1/. Tobey, R.A.; Crissman, H.A.; Wilder, M.E.; Traganos, F.; Darzynkiewicz, Z. (Los Alamos National Lab., NM (USA); Sloan-Kettering Inst. for Cancer Research, New York (USA)). *Cell and Tissue Kinetics;* **20**: No. 3, 363-366(May 1987).

A population of line CHO Chinese hamster cells was synchronized by mitotic selection and allowed to enter early G/sub 1/, after which the largest and smallest cells in the population were sorted, irradiated, and their viability determined. Despite sizeable differences in volume, metabolic capability and cell cycle progression rates, an equivalent level of survival was obtained for the two populations, indicating that the factors responsible for the volume, metabolic and progression heterogeneity do not contribute greatly to radiation sensitivity.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 25107, 25108, 25109, 25110, 25111, 25112, 25123, 25213

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 24071, 25005, 25007, 25048, 25049, 25052, 25082, 25113, 25114, 25135, 25158

25238 (EPRI/EA/EL—5612) **Proceedings: 1987 EPRI PCB [polychlorinated biphenyl] seminar.** Addis, G. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1988. 394p. (CONF-8710221—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920188/JAW.

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

More than 60 presentations summarized research in such areas as PCB destruction, analysis, spill cleanup, risk analysis, and fires, as well as mineral oil decontamination and retrofill and replacement fluids. PCB destruction discussions focused on thermal treatment of PCB and PCB-contaminated soils, as well as sampling and analysis criteria for evaluating destruction methods. Other areas of discussion included processes for removing PCB from contaminated transformer oil and coolants, equipment for testing PCB-contaminated soils, PCB environmental transports, and pyrolysis and combustion of PCB-contaminated transformer fluids. Several papers described pilot plant projects, case studies demonstrating new equipment, processes and cleanup methods, and commercial PCB removal processes. Some technologies described at previous seminars have advanced to commercial or semicommercial stages. One such technology is retrofilling, replacing either PCB or contaminated oil with fresh oil to reduce PCB content, usually to below the strictest EPA regulatory level of 50 ppB. Improved techniques for decontaminating mineral oil containing PCB are commercially available. Spill cleanup and disposal of askarel transformer carcasses are areas that still require improvements. Ongoing EPRI work is studying disposal techniques for detanking transformers and dismantling and cleaning components for scrap or disposal. Individual papers are processed separately for the data base.

25239 (LBL—22300, pp 65-66) **Effects of ozone and hypoxia on thyroid hormone receptors.** Erkenbrack, D.E.; Clemons, G.K. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

This potentiation of ozone toxicity by thyroid hormones is consistent with the general catabolic effects of overconveyance of these hormones seen most strikingly in thyrotoxicosis. All effects of these hormones thus far examined have been found to be mediated by receptors, primarily those in the nucleus. Utilizing a sensitive assay for characterizing these receptors, we explored the interaction between thyroid hormones and ozone toxicity in lung tissue. The results partially resolve the mechanism of this interaction. Ozone exposure causes prompt and sustained increases in lung nuclear T3 receptor levels. Scatchard analysis of the data reveals no significant change in receptor affinity, indicating that ozone does not affect the basic structure or conformation of the receptor molecule. An increase in receptor levels was not seen in parallel studies done on liver receptors in which both control and ozone exposed groups had normal affinities and capacities. In view of the catabolic effects of saturating a tissue's thyroid hormone receptors (as in thyrotoxicosis), it seems likely that some of the catabolic effects of ozone exposure are mediated through an increase in receptor levels. 1 ref., 1 fig.

25240 (LBL—22300, pp 241-245) **Carcinogenic potency.** Gold, L.S.; Ames, B.N.; Magaw, R.I.; Backman, G.M.; Slone, T.H.; Schwalbe, J.; Da Costa, M.; Eisenberg, S.; Chous, P.; Cabras, V. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The Carcinogenic Potency Database is an attempt to quantify and standardize the animal bioassay literature and to organize it systematically. In the past, efforts to use animal bioassays in the evaluation of the potential health risk of chemicals to humans were hampered by the lack of standardized method of comparing experimental results. Experimental protocols as well as the type of information reported in the literature are quite diverse. Moreover, quantitative estimates of carcinogenic potency had not been made for large numbers of chemical carcinogens. 10 refs., 1 fig., 1 tab.

25241 (LBL—22300, pp 256-257) **Production of oxidative base damage by benzo(a)pyrene metabolism and ionizing radiation in human mammary epithelial cells.** Leadon, S.A.; Stampfer, M.; Yang, T.; Bartley, J. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Damage to DNA by active oxygen species can result in single- and double-strand breaks, apurinic and apyrimidinic sites, and ring-saturated thymine derivatives, such as 5,6-dihydroxydihydrothymine (thymine glycol). In order to understand the role of indirect action produced by chemicals or radiation in carcinogenesis, it is important to identify the primary DNA lesions and ascertain how these lesions are processed at the molecular level. A monoclonal antibody that recognizes thymine glycols in DNA has been developed and used in a sensitive immunoassay. The sensitivity of this assay is sufficient to detect 1 thymine glycol per 8.5 x 10^5 bases in DNA. 1 ref., 1 fig., 1 tab.

25242 (NP—8770102) **Experiments on the induction of an acute lead effect in chronically exposed rabbits by means of mobilisation.** Detering, R. (Tieraerztliche Hochschule Hannover (Germany, F.R.)). 26 Jun 1986. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770102/JAW.

The possibility of an acute lead action by mobilisation of lead from body deposits was studied in chronically lead-exposed male rabbits by measuring specific lead-sensitive parameters. 11 and 35 male rabbits were given different amounts of lead with the drinking water for a period of 5 and 6 months in two different experiment sequences. By various procedures it was tried to influence the calcium metabolism of the animals to mobilize the lead deposits in the bone. The following measurements were used as parameters of lead action: 1. The activity of the delta-aminolevulinic acid dehydratase (ALA-D) in red blood cells. 2. The reactivated part by glutathion (ALA-D-GSH). 3. The concentration of free porphyrines (FEP) in red blood cells. The results of this research show a possible evidence about an acute lead action caused by mobilisation of lead from body deposits.

25243 (PNL—6100-Pt.2, pp 17-19) **Soil/plant behavior of organic xenobiotics.** Cataldo, D.A.; Fellows, R.J.; Bean, R.M. Sep 1987. NTIS, PC A04/MF A01. Order Number DE88000664/JAW.

In Pacific Northwest Laboratory: Annual report for 1986 to the DOE Office of Energy Research: Part 2, Environmental sciences.

In the present studies, the comparative behavior and chemical fate of organic residues in plants are evaluated in simple soil and hydroponic systems. Organic compounds were selected from the 28 representative species comprising seven compound classes currently being evaluated in DOE/OHER subsurface transport programs. The objectives of these studies are to establish (1) root absorption rates for individual organic residues, (2) plant mobility and distribution patterns, (3) rates of foliar volatilization and reemission to the atmosphere, and (4) the chemical fate of these compounds once accumulated. Four compounds, representing four of the compound classes, have been studied: phenol, aniline, quinoline, and most recently indole. The wide range in relative behavior and chemical fate observed with these compounds serves to demonstrate the complexities involved in understanding the environmental behavior of xenobiotics.

25244 (PNL—6186) **Review and evaluation of the effects of xenobiotic chemicals on microorganisms in soil.** Hicks, R.J.; Van Voris, P. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 87p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006244/JAW.

The primary objective was to review and evaluate the relevance and quality of existing xenobiotic data bases and test methods for evaluating direct and indirect effects (both adverse and beneficial) of xenobiotics on the soil microbial community; direct and indirect effects of the soil microbial community on xenobiotics; and adequacy of test methods used to evaluate these effects and interactions. Xenobiotic chemicals are defined here as those compounds, both organic and inorganic, produced by man and introduced into the environment at concentrations that cause undesirable effects. Because soil serves as the main repository for many of these chemicals, it therefore has a major role in determining their ultimate fate. Once released, the distribution of xenobiotics between environmental compartments depends on the chemodynamic properties of the compounds, the physicochemical properties of the soils, and the transfer between soil-water and soil-air interfaces and across biological membranes. Abiotic and biotic processes can transform the chemical compound, thus altering its chemical state and, subsequently, its toxicity and reactivity. Ideally, the conversion is to carbon dioxide, water, and mineral elements, or at least, to some harmless substance. However, intermediate transformation products, which can become toxic pollutants in their own right, can sometimes be formed. 139 refs., 6 figs., 11 tabs.

5604 Other Environmental Pollutant Effects

25245 (LBL—22300, pp 66-74) **Biological effects of magnetic fields.** Tenforde, T.S.; Gaffey, C.T.; Liburdy, R.P.; Lo, Chu-Chung; Geyer, A.B.; Levy, L. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

The objectives of the magnetic field research program are the development of a detailed theoretical and experimental understanding of the mechanisms through which these fields interact with biological systems, the acquisition of laboratory data on the response of living systems to magnetic fields at the cellular, tissue, and animal levels, the development of advanced microprocessor-controlled dosimeters for characterizing human exposure to static and time-varying magnetic fields, and the assessment of possible health tasks to humans exposed to high-intensity magnetic fields in various industrial, research, and medical technologies. Progress in three selected areas of the magnetic field research program is described in this year's annual report. 10 refs., 10 figs.

25246 (LBL—22300, pp 74-78) **Electromagnetic fields and the induction of protein shedding.** Liburdy, R.P. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

This study has demonstrated that electromagnetic fields operate to influence the protein composition of erythrocyte. This phenomenon of protein shedding is observed to occur over a restricted temperature range of 17-21°C which correspond with the presence of membrane phase transition. It is likely that conformational changes associated with the phase transition, e.g., membrane phospholipid chain and head-group reorientation and protein vertical extrusion away from the plane of the cell membrane, may significantly increase the absorption of electromagnetic energy in the erythrocyte membrane and thereby facilitate the release of protein. This is supported by measurements of energy absorption in unilamellar liposome vesicles that demonstrate that electromagnetic energy absorption is markedly increased at the membrane phase transition. The characterization of physical changes that we observe during field treatment involve the shedding of at least 11 protein species, which takes place in a temperature- and oxygen-dependent manner, and the release of 28-31 kDa species that are stabilized by divalent calcium bridges. Field treatment is also associated with the shedding of major protein components that possess relatively cationic and/or nonpolar domains. 6 refs., 5 figs.

57 HEALTH AND SAFETY

25247 (EUR—11072-EN) **Survey of industrial accident databases.** Bockholts, P.; Heidebrink, I.; Moss, T.R.; Butler, J.A.; Florentini, C. (Commission of the European Communities, Luxembourg. Directorate General Telecommunications, Information Industries and Innovation). May 1987. 89p. Commission of the European Communities, Luxembourg. Office for Official Publications of the European Communities.

Physical scienoes.

The report reviews the state of the art of industrial accident databases, as it has resulted from a study committed to TNO, RMC and TECSA by JRC, Ispra in the frame of its research programme on industrial risk. The study has been limited to selected E.C. countries (France, Germany, Italy, the Netherlands and the United Kingdom) and the United States of America. The study has been performed through inquiry letters and visits payed to selected organizations, and has been completed by end of 1985. Although the collected information varies between the different countries an underlying theme is evident. It is clear that the majority of incident reporting systems are focussed on injuries and fatalities, whereas information on the causes including technical information on the phenomena associated with the incident is rather scarce. Consequently data that could be directly applicable for safety assessments and for prevention policy are rather limited.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 24077, 24167, 25257

25248 (BNL—40550) **^{137}Cs radioactive dating of Lake Ontario sediment cores.** Ward, T.E.; Breeden, J.; Komisarcik, K.; Porter, R.; Czuczwa, J.; Kaminski, R.; McVeety, B.D. (Brookhaven National Lab., Upton, NY (USA); Indiana Univ. Cyclotron Facility, Bloomington (USA); Indiana Univ., Bloomington (USA)). Dec 1987. Contract AC02-76CH00016. 11p. (CONF-871259—2; BNL/NPB—87-109). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005034/JAW.

From American Chemical Society meeting; Little Rock, AR, USA (3 Dec 1987).

The distribution of ^{137}Cs in sediment cores from Lake Ontario provides estimates of the sediment accumulation rates. Geochronology with ^{210}Pb dating and distribution of Ambrosia (ragweed) pollen compare well with ^{137}Cs dating. These methods can determine with precision, changes in sedimentation occurring over the past 100 years or so. Typical sedimentation rates of 0.18-0.36 cm/yr were measured. 16 refs., 3 figs., 2 tabs.

25249 (DOE/ER/13555—1) **Stratigraphy, structure, hydrothermal alteration and ore mineralization encountered in CSDP [Continental Scientific Drilling Program] corehole VC-2A, Sulphur Springs Area, Valles Caldera, New Mexico: A detailed overview.** Hulen, J.B.; Gardner, J.N.; Nielson, D.L.; Goff, F. (Utah Univ. Research Inst., Salt Lake City (USA)). Feb 1988. Contract FG02-86ER13555;W-7405-ENG-36. 58p. (LA-UR—88461; ESL—88001-TR). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006109/JAW.

The pyroclastic and volcaniclastic rocks penetrated by the corehole are readily recognizable from previous studies of the Valles calderas surface and subsurface, and include most major members of the 3.6-<1.12 Ma intracaldera volcanic sequence. Continuous core from VC-2A, however, has revealed critical textural and structural features of these rocks not apparent from earlier investigations based on small-diameter drill cuttings; paragenetic relationships among hydrothermal phases have been similarly clarified. Our work to date on the VC-2A core has led to the major preliminary conclusions. 35 refs., 3 figs.

25250 **Effectiveness of Geologic Characterization techniques, Climax Granitic Stock, Nevada Test Site.** Wilder, D.G.; Yow, J.L. Jr. (Lawrence Livermore National Laboratory, P.O. Box 808, L-204, Livermore, CA 94550 (USA)). *Bulletin of the Association of Engineering Geologists;* **24**: No. 4, 537-548(Jan 1986). Contract W-7405-ENG-48.

Also available as Lawrence Livermore National Laboratory Report UCRL-92687.

Several different techniques were used to characterize the structural geology of the quartz monzonite unit of the Climax Stock. This study examined major geologic structural features and yielded detailed data on over 1,500 fractures. The data were used to identify joint sets, faults and shear zones as well as to statistically analyze joint frequencies and spacings. Eight joint sets, three major shear sets, and a fault zone were studied. The results of previous geologic characterization work performed by many other investigators were compared with the results of our studies. These data provided the basis for evaluating how effective various techniques were in describing the structural geology of the Climax Stock. The specific techniques that were evaluated included the use of unoriented diiamond drilled core, mappoing of only major fractures within the drifts, detailed mapping using modified scan-line techniques, data reduction techniques to account for orientation biases, and surface trench mapping. The results of this study identified several issues for consideration during characterization studies. Firstly, geologic structural features that are often assumed to be uniform and continuous were shown to change characteristics within very short distances. Secondly, we demonstrated that when applied properly to an adequate data set, orientation bias correction techniques were effective in identifying all fracture sets. Thirdly, we demonstrate that unless three nearly equal length orthogonal surfaces are mapped, interpretations of spacing or of joint prevalence can be misleading. Finally, we demonstrate the usefulness of mapping only isolated and limited sized areas in detail with more general or reconnaissance mapping of the entire facility to tie the detailed map sections together and to identify major features. 10 refs., 23 figs., 2 tabs.

5802 Geophysics

REFER ALSO TO CITATION(S) 24352, 24991, 25264

25251 **(DOE/ER/13221—2) A comprehensive study of the seismotectonics of the eastern Aleutian arc and associated volcanic systems: Technical progress report, April 1, 1984-March 31, 1987.** Jacob, K.H.; Taber, J.; Boyd, T. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). Jul 1986. Contract FG02-84ER13221. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005039/JAW.

Peculiar stress anomalies in the descending slab have been documented by composite focal mechanisms to be associated with the zone that in 1978-80 slipped aseismically at depth. The exact geometry of the descending slab has been delineated with the help of three-dimensional ray tracing. The detailed seismicity, tectonics and seismic potential of the Unalaska seismic gap have been reviewed. It is believed to be presently capable of a Mw $\approx$ 8.6 earthquake. A thorough analysis of the volcano seismicity of Pavlof volcano indicates a close correlation of seismic signals with periods prior and during eruptions, probably related to degassing of mobile magma in the upper 1.6 km of the volcanic vent. After some quiescence in 1985 Pavlof erupted vehemently in spring 1986 and is still active at present. A strong (10%) low-velocity anomaly in the crust beneath Pavlof volcano and Emmons caldera has been detected. Strong-motion data for most of Alaska, including those collected by the Shumagin accelerometer array have been analyzed and indicate high peak accelerations and large scatter. A thorough review of the seismic and volcanic hazards in the Gulf of Alaska has been completed. Research results for the period 1984 to 1986 were reported in 18 publications some of which are reproduced in this report. 26 refs.

25252 **(DOE/ER/13472—2) Two and three dimensional inversion of magnetotelluric data: Annual report No. 2.** Booker, J.R. (Washington Univ., Seattle (USA)). Feb 1988. Contract FG06-86ER13472. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006905/JAW.

We have developed an efficient iterative inversion method applicable to both 2 and 3-D magnetotelluric data. The method approximates horizontal derivative terms with their values calculated from the fields of the previous iteration. The equations at each horizontal coordinate then become uncoupled and 1-D with an added term containing the effects of the horizontal derivatives. At each iteration this allows separate 1-D inversions for the conductivity profile beneath each measurement site. Resultant profiles are interpolated to form a new multi-dimensional model for which the fields are calculated. Residuals to this new model are used in the next iteration. The method is very fast, as partial derivatives are calculated for 1-D problems only and computation time grows only linearly with the number of sites of data inverted. Preliminary tests with 2-D data show very promising results. Some practial problems remain in application of the algorithm to real 2-D data. We are requesting continued support to resolve these questions and to extend the method to 3-D.

25253 **(LBL—24571) Using surface displacement to constrain deformation at Long Valley caldera, California.** Vasco, D.W.; Johnson, L.R.; Goldstein, N.E. (Lawrence Berkeley Lab., CA (USA)). Mar 1987. Contract AC03-76SF00098. 9p. (CONF-8703199—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006330/JAW.

From Symposium on the Long Valley caldera: pre-drilling data review; Berkeley, CA, USA (17 Mar 1987).

This paper discusses models used to characterize the vertical displacement measured within Long Valley caldera. 12 refs., 1 tab. (LSP)

5803 Mineralogy, Petrology, And Rock Mechanics

25254 **(SKB-TR—86-28) Pressure solution of minerals in quartz-type buffer materials.** Erlstroem, M. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1986. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751042/JAW.

Two samples, pure quartz sand and a sand-bentonite (10%) mixture, were tested under conditions of high pressure (200 bar) and temperature (115/sup 0/C). The experiment was carried out over a period of 70 days. A series of thin slides were prepared on a resin embedded sample at the end of the test period. A microscopical study was performed as to obtain data concerning the effects of pressure and temperature. It showed that no pressure solution had taken place in the pure quartz sand. However, the individual grains had been severely fractured, thus causing significant internal sedimentation. The mixed sample showed that the clay component coated the quartz grains and significantly decreased the effect of stress in the grains by having a cushioning effect. Relative grain movement was facilitated by the clay, by which the grains rotated and slipped into stable positions with large contact areas and low contact stresses. This probably minimized pressure solution. However, a few contact regions indicated the presence of precipitated silica. The investigation shows no definite evidence of pressure solution after an experiment duration of 70 days. Since the effect of solution may be time dependent at the applied temperature, it is recommended that further experiments be conducted at higher effective and porewater pressures but still at 115/sup 0/C.

25255 **A numerical model for simulating dynamic processes in rocks.** Margolin, L.G.; Smith, B.W. (Los Alamos National Lab., NM). pp 489-494 of Numerical methods in geomechanics. Kawamoto, T.; Ichikawa, Y. Accord, MA; International Publishers Service Inc. (1985). (CONF-850426—).

From 5. international conference on numerical methods in geomechanics; Nagoya, Japan (1 Apr 1985).

The authors present a constitutive model for porous/brittle rocks. The model uses a microphysical approach, describing fracture in terms of the growth of cracks, and compaction in terms of

the plastic collapse of spherical pores. Particular attention is paid to the construction and use of effective moduli. A numerical calculation is presented of stress wave propagation and spall due to a buried explosive.

5804 Geochemistry

REFER ALSO TO CITATION(S) 24074, 24978, 25088

25256 (BNL—40763) Location and mapping of gold sites in unoxidized Carlin-type ores. Chen, J.R.; Back, J.M.; Chao, E.C.T.; Minkin, J.A.; Hanson, A.L.; Jones, K.W.; Rivers, M.L.; Sutton, S.R. (State Univ. of New York, Geneseo (USA); Geological Survey, Reston, VA (USA); Brookhaven National Lab., Upton, NY (USA); Chicago Univ., IL (USA)). 1987. Contract AC02-76CH00016. 5p. (CONF-8708180—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006354/JAW.

From Symposium on X-ray microscopy; Upton, NY, USA (31 Aug 1987).

Established micro-techniques (optical, scanning electron microscopy augmented with energy dispersive x-ray analysis (SEM-EDX), and electron probe microanalysis (EPMA) have been combined with the relatively new synchrotron-induced x-ray fluorescence (SXRF) microprobe technique to obtain specific data on the occurrences of gold in Carlin-type ores. An SXRF map of the Au in a 1.0 x 1.4 mm^2 region of a sample has been made. We describe the complementary nature of these microanalytical techniques and how they provide a relatively quick, effective way of pinpointing the location of discrete gold particles $\geq$ 0.2 μm diameter at the surface of a sample. 8 refs., 2 figs., 1 tab.

25257 (KURRI-TR—275) Proceedings of the KURRI [Kyoto University Research Reactor Institute] symposium on characterization of aqueous solution systems. Matsui, Masakazu; Koyama, Mutsuo; Kobayashi, Mitsue (eds.). (Kyoto Univ. (Japan)). Mar 1986. 91p. (In Japanese). NTIS (US Sales Only), PC A05. Order Number DE88900374/JAW.

The principal topics were selected on the fundamental problems such as thermodynamics, molecular dynamics, solvation mechanisms, electrolyte solutions, and electrochemical approaches. In particular, papers on the origin and role of water in geochemistry were invited to have an opportunity to exchange ideas from the macroscopic levels to the microscopic ones, since water, one of the most abundant and common liquids on the surface of our planet, possesses unique characteristics if examined from view point of physico-chemical properties as an solvent. Models at high temperature and pressure of water systems have come in reality such as in nuclear plants in which fundamental approaches should be required although the problems arisen have been overcome by engineering procedures. The black smokers found in deep oceanic ridges are also encouraging to elucidate the properties of water at abnormal conditions.

5805 Oceanography

REFER ALSO TO CITATION(S) 25088

25258 (CONF-8603239—) Baltic Sea environment proceedings No. 19: Baltic Sea monitoring symposium. (Baltic Marine Environment Protection Commission, Helsinki (Finland)). 1987. 567p. NTIS (US Sales Only), PC A24/MF A01. Order Number DE88900439/JAW.

From Baltic Sea monitoring symposium; Tallinn, USSR (10 Mar 1986).

The Baltic Sea Monitoring Symposium was organized by the USSR State Committee for Hydrometeorology and Environmental Control in cooperation with the Baltic Marine Environment Protection Commission - Helsinki Commission, in Tallinn, USSR. The aim of the Symposium was focused on the marine environment of the Baltic Sea, to discuss the results of the Baltic Monitoring Programme, started in 1979, to evaluate the monitoring results and to consider the necessity of monitoring programmes as well as assessments on the state of the Baltic Sea. The scientific presentations were given both orally and as posters. The papers published in this volume contain the lectures and the summaries of posters which were submitted by the authors to the organizers with the view to their publishing in the Symposium Proceedings. Individual papers are indexed separately for the data base.

25259 (DOE/ER/60285—T1) Simulation analysis of moored fluorometer time series from the Mid-Atlantic Bight: Progress report for FY 1986-87. Walsh, J.J. (University of South Florida, St. Petersburg (USA). Dept. of Marine Science). 1987. Contract FG05-85ER60285. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006066/JAW.

During FY 1986-87, a great deal of effort was devoted to synthesis of the results from the SEEP-I field experiment, conducted in 1983-1984, south of Martha's Vineyard and Long Island. As guest editor of a special SEEP-I volume of Continental Shelf Research, 20 manuscripts were reviewed and accepted for publication, of which three were written by the author. In summary, the component of the multidisciplinary SEEP-I program found from the 1984 time series of moored instruments that a seaward export of perhaps 0.20 mg chl m^{-3} day^{-1} evidently occurred at depths of 75 to 81 m, between the 80- and 120-m isobaths during February-April 1984. Using a C/chl ratio of 45/1, such a horizontal loss of algal carbon over the lower third of the water column would be 19 to 67% of the March-April 1984 primary production within the overlying euphotic zone.

25260 (DOE/ER/60340—2) [The role of zooplankton and micronektron in the cycling and remineralization of chemical materials in the Southern California Bight: Progress report, November 1985-June 1986]. (Oregon State Univ., Corvallis (USA)). Jun 1986. Contract FG05-85ER60340. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006062/JAW.

A Progress Report on Grant FG05-85ER60340 has already been submitted to DOE, and is appended here. The appended report covers much of the work completed during the current contract period. Work on the just-completed May 1986 cruise samples is just beginning at the time of writing. Sediment traps deployed at two locations in Santa Monica Basin in October 1985 were recovered in February 1986. The traps have sequentially rotating cups set to collect material for 14 days each during the deployment period. We have finished radiochemical analyses on the sediment trap samples collected on the February 1986 Cruise. Pellet production rates for salps and euphausiids were reported earlier. The February cruise was principally a hydrographic and trap recovery cruise, and there was no time for pellet production rate experiments. Thus, all the February hauls are being analyzed to assess diel biomass estimates of selected size classes of zooplankton in the vicinity of the traps. 5 tabs.

25261 (DOE/ER/60354—3) Biological processes in the water column of the south Atlantic bight: Zooplankton responses: Progress report. Paffenhoefer, G.A. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 16 Dec 1987. Contract FG09-85ER60354. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88004811/JAW.

The studies on which we report in the following segments represent interdisciplinary efforts to understand interactions of physical, chemical and biological processes on the southeastern continental shelf of the USA. The Georgia Bight Experiment was designed to determine the physical forces responsible for upwelling on the northeastern Florida and Georgia shelf during summer, trajectories and fate of those upwellings, and major chemical and biological processes therein. 5 refs.

64 PHYSICS I

25262 (DOE/ER/40093—T1-Vol.1) Physics through the 1990s: A summary. (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 29p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006390/JAW.

This summary presents some highlights of the recently released physics survey Physics Through the 1990s. The purpose of

the survey is to provide an authoritative research assessment of the major fields of physics. To accomplish that, the Physics Survey Committee prepared six volumes on the fields of physics and two cross-cutting volumes - Scientific interfaces and Technological Applications and An Overview. This brief summary can do little more than pique the reader's interest in the more complete treatment in those eight volumes, which provide convincing documentation of a physics enterprise that is vital and productive. The summary is organized into three parts. The first part sketches the progress that has occurred over the past decade and gives an indication of where the field is headed. Only a few highlights have been included; in each field of physics, important elements have been omitted for the sake of brevity. The second part relates physics to other sciences and the needs of society. The first two sections are quite selective; applications have received strong emphasis as a principal theme of this summary. The third part indicates some of the requirements for maintaining excellence in physics and includes a brief synopsis of the major recommendations of the Physics Survey Committee.

25263 **(DOE/ER/40093—T1-Vol.2) Physics through the 1990s: An overview.** (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88006391/JAW.

This Overview summarizes and addresses issues that broadly concern physics. The role of physics in society is discussed. Highlights of the progress and the opportunities in each subfield, plus the future needs and recommended action are described. In addition, there are three supplements on issues that cut across the individual fields: international aspects of physics, education and supply of physicists, and organization and support of physics.

25264 **(DOE/ER/40093—T1-Vol.4) Physics through the 1990s: Scientific interfaces and technological applications.** (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 283p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88006393/JAW.

Physics traditionally serves mankind through its fundamental discoveries, which enrich our understanding of nature and the cosmos. While the basic driving force for physics research is intellectual curiosity and the search for understanding, the nation's support for physics is also motivated by strategic national goals, by the pride of world scientific leadership, by societal impact through symbiosis with other natural sciences, and through the stimulus of advanced technology provided by applications of physics. This Physics Survey volume looks outward from physics to report its profound impact on society and the economy through interactions at the interfaces with other natural sciences and through applications of physics to technology, medicine, and national defense.

25265 **(ILL—87CA03G) ILL experimental reports and theory college activities.** (Institut Laue-Langevin, 38 - Grenoble (France)). 1987. 523p. NTIS (US Sales Only), PC A22/MF A01. Order Number DE88752163/JAW.

This volume is the collection of reports describing experimental work performed at the I.L.L. They have been arranged by subject (from the I.L.L. classification scheme) and are published under their proposal number. (Only those reports received up to Jan. 19, 1987 have been included). In order to have connection between the theory group and the experimental activities of the I.L.L., scientific activity of theoreticians has been included in the form of a personal review of activity. For any further details, readers should contact directly individual scientists.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 25320, 25326

25266 **(CONF-8612112—2) Ground-based gamma-ray astronomy: An overview.** Lamb, R.C. (Iowa State Univ. of Science and Technology, Ames (USA)). 1986. Contract AC02-80ER10774. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006083/JAW.

From 13. Texas symposium on relativistic astrophysics; Chicago, IL, USA (25 Dec 1986).

A brief overview of ground-based gamma ray astronomy is given. Seven sources have been confirmed at energies greater than 1 TeV. Particular emphasis is given to the Crab Pulsar, Cygnus X-3 and Hercules X-1. 20 ref., 3 figs.

25267 **(DOE/ER/40093—T1-Vol.3) Physics through the 1990s: Gravitation, cosmology, and cosmic-ray physics.** (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 183p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88006392/JAW.

This report reviews and highlights three areas of astrophysics; gravitation; cosmology; and cosmic-ray physics. Topics such as: gravitational collapse and black holes, gravitational waves, general relativity, nucleosynthesis, and the standard model are among the many topics highlighted. (LSP)

25268 **(FNAL/Pub—87/209-A) Finite width corrections to the Nambu action for the Nielsen-Olesen string.** Maeda, K.; Turok, N. (Fermi National Accelerator Lab., Batavia, IL (USA); Tokyo Univ. (Japan). Dept. of Physics). Nov 1987. Contract AC02-76CH03000. 12p. (UTAP—66/87). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006996/JAW.

The finite width correction terms to the Nambu action for Nielsen-Olesen strings are calculated. They consist of an extrinsic curvature squared or rigidity term and a new 'twist' term. The extrinsic curvature term prevents cusps forming, rounding them off with a curvature radius of the order of the string width. 12 refs.

25269 **(FNAL/Pub—87/215-A) String driven inflation.** Turok, N. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1987. Contract AC02-76CH03000. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006994/JAW.

It is argued that, in fundamental string theories, as one traces the universe back in time a point is reached when the expansion rate is so fast that the rate of string creation due to quantum effects balances the dilution of the string density due to the expansion. One is therefore led into a phase of constant string density and an exponentially expanding universe. Fundamental strings therefore seem to lead naturally to inflation. 17 refs., 1 fig.

25270 **(FNAL/Pub—88/20-A) The Lithium isotope ratio in Population II halo dwarfs: A proposed test of the late decaying massive particle nucleosynthesis scenario.** Brown, L.; Schramm, D.N. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1988. Contract AC02-76CH03000. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006997/JAW.

It is shown that observations of the Lithium isotope ratio in high surface temperature Population II stars may be critical to cosmological nucleosynthesis models. In particular, decaying particle scenarios as derived in some supersymmetric models may stand or fall with such observations. 15 refs., 3 figs., 2 tabs.

25271 **(IC—87/123) Propagation of inernio-acoustic gravity waves in a rotating and radiating opaque atmosphere.** Bestman, A.R. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701866/JAW.

The critical level for wave propagation is studied in the presence of radiation driven winds using a hydrodynamic model. As a result of the extremely complex nature of the problem, the galaxy is assumed opaque so that the optically thick gas approximation of radiation is invoked. Further the frequencies involved in the wave motion are taken fairly high so that the wave is essentially adiabatic. Despite these idealizations, the wave motion is governed by a fourth order ordinary differential equation with variable coefficients. The simplest configuration studied by the classical Frobenius method involves three waves which propagate across the critical level (regular singular point) attenuated, while the fourth is attenuated/amplified on crossing the critical level. This constitutes the well-known valve effect, which is enhanced by radiation. (author). 4 refs.

25272 **(IC—87/130) Cosmic wavefunction with induced gravity.** Mo, H.J.; Fang, L.Z. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701873/JAW.

The Hartle-Hawking cosmic wavefunction is calculated in a model with induced potential. It is found that quantum cosmology can explain the existences of physical constants such as gravitational constant and cosmological constant. (author). 7 refs.

25273 **(IC—87/150) Nonlinear propagation of Alfven waves in cometary plasmas.** Lakhina, G.S.; Shukla, P.K. (International Centre for Theoretical Physics, Trieste (Italy); Bochum Univ. (Germany, F.R.)). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701892/JAW.

Large amplitude Alfven waves propagating along the guide magnetic field in a three-component plasma are shown to be modulationally unstable due to their nonlinear interaction with nonresonant electrostatic density fluctuations. A new class of subsonic Alfven soliton solutions are found to exist in the three-component plasma. The Alfven solitons can be relevant in explaining the properties of hydromagnetic turbulence near the comets. (author). 15 refs.

25274 **(INFN/BE—86-5) Progress in ^{10}Be and ^{36}Cl measurements with the AMS [accelerator mass spectrometry] system of the Laboratori Nazionali Di Legnaro.** Tuniz, C.; Rui, R.; Bonetti, R.; Fioretto, E.; Marcazzan, G.M.; Stievano, B.M; Spolaore, P.; Rudello, P.; Sartori, S.; Herzog, G.F.; Moniot, R.K. (Trieste Univ. (Italy). Dipartimento di Fisica; Istituto Nazionale di Fisica Nucleare, Legnaro (Italy). Lab. Nazionale di Legnaro; Istituto Nazionale di Fisica Nucleare, Trieste (Italy); Pauda Univ. (Italy). Dipartimento di Fisica; Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Chemistry; Fordham Univ., New York (USA)). 10 Nov 1986. 11p. (CONF-8606257—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900407/JAW.

From International workshop in accelerator mass spectrometry; Oxford, UK (30 Jun 1986).

Recent measurements with the AMS system of the Laboratori Nazionali di Legnaro are reported. ^{10}Be has been measured in a sample of an artificial meteorite previously analyzed at Rutgers University. ^{36}Cl is identified in standard samples by using a Bragg chamber. Present sensitivity allows measurements of cosmogenic ^{10}Be and ^{36}Cl in meteorites. 3 refs., 3 figs.

25275 (INIS-mf—10567, pp 191-211) **Compact stellar objects: calculations for various equations of state at zero temperature.** Eggers, H.C.; Schnabel, A.C.; Rafelski, J. (Institute of Theoretical Physics and Astrophysics, University of Cape Town, South Africa). 1986. NTIS (US Sales Only), PC A12/MF A01. Order Number DE87701986/JAW. (CONF-8607120—; CONF-8507150—).

From 21. annual seminar on theoretical physics; Johannesburg, South Africa (8 Jul 1986).

The papers on the 20th and 21st annual seminars on theoretical physics are bound in one volume.

Expertise has been developed in calculating the structure of compact stars consisting of one or more component Fermi gases at zero temperature. Using an improved equation of state that incorporates the effects of compressible finite neutron size, we find a new structure and new mass limits for neutron stars. In considering the possibility of a core consisting of massless quarks, we find that such a core develops above rho -- 560 MeV/fm/sup 3/ = 1.0 x 10/sup 15/g/cm/sup 3/.

25276 (INIS-mf—10567, pp 119-127) **Neutrino-phonon scattering and the detection of cosmic background neutrinos.** Tupper, G.; Rafelski, J. (Institute of Theoretical Physics and Astrophysics, University of Cape Town, South Africa). 1986. NTIS (US Sales Only), PC A12/MF A01. Order Number DE87701986/JAW. (CONF-8607120—; CONF-8507150—).

From 21. annual seminar on theoretical physics; Johannesburg, South Africa (8 Jul 1986).

The papers on the 20th and 21st annual seminars on theoretical physics are bound in one volume.

The issues accessible in cosmic neutrino background astronomy and the possible realizations in terms of neutrino-phonon scattering are discussed. A workable detector scheme is not presented here. The standard hot big-bang cosmology predicts that in addition to the well known cosmic microwave background (CγB), there should also exist a cosmic neutrino background (CνB). Observation of the CνB would allow a probe of early universe and neutrino masses.

25277 **(KFKI—1987-50/C) Plasma phenomena around comets: interaction with the solar wind.** Sagdeev, R.Z.; Shapiro, V.D.; Shevchenko, V.I.; Szegoe, K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Aug 1987. 11p. (CONF-870723—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88701764/JAW.

From 18. international conference on phenomena in ionized gases; Swansea, UK (13 Jul 1987).

The most important plasma physical experimental data measured during the cometary missions are summarized. These data do not include tail phenomena. Theoretical considerations are also presented concerning the upstream and bow shock regions. (author) 47 refs.; 15 figs.

25278 **(RAL—88-005) Neutron oscillations and the primordial magnetic field.** Sarkar, S. (Rutherford Appleton Lab., Chilton (UK)). Jan 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88752796/JAW.

It has been claimed that a primordial magnetic field must exist in order to suppress possible oscillations of neutrons into antineutrons which would otherwise affect the cosmological synthesis of helium. We demonstrate that such oscillations, even if they do occur, have a negligible effect on primordial nucleosynthesis, thus refuting the above claim. Hence the possible existence of a primordial magnetic field, relevant to current speculations concerning superconducting 'cosmic strings', remains an open question.

25279 **(RRK—87-24) On a scalar field in Nariai's universe with the topology S tilde/sub 2/ x S/sub 2/.** Nariai, Hidekazu. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Oct 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752331/JAW.

As a requel to the previous note (Preprint RRK 84 - 19) dealing with a quantized scalar field in the de Sitter and Nariai universes (both satisfy the vacuum Einstein equations R/sub $\mu\nu$/ = Λg/sub $\mu\nu$/), a scalar field in Nariai's universe with the topology S tilde/sub 2/ x S/sub 2/ is worked out. The relating metrics specified by Eq.(2.1) are reduced not only to f(t) = e/sup t/a/ (ϵ = 0, dealt with in RRK 84 - 19), but also to f(t) = ch(t/a)(ϵ = 1) or sh(t/a)(ϵ = -1) (all of them satisfy the same equation f/f = 1/a/sup 2/), where A(t) = a ident to 1/√Λ. The differential equation (2.13) for T/sub kl/(t) (which is the time-dependent part of the scalar field phi(t,x)) is solved in the three cases ϵ = 0 and ϵ = +- 1, except for the fixation of complex constants B/sub k/ and C/sub k/ (chemical bondB/sub k/chemical bond/sup 2/-chemical bondC/sub k/chemical bond/sup 2/ = 1).

25280 **Nearly normal galaxies: from the Planck time to the present; Proceedings of the Eighth Santa Cruz Summer Workshop in Astronomy and Astrophysics, Santa Cruz, CA, July 21-Aug. 1, 1986.** Faber, S.M. New York, NY; Springer-Verlag (1987). 477p. (CONF-8607362—).

From 8. Santa Cruz summer workshop in astronomy and astrophysics: nearly normal galaxies: from the Planck time to the present; Santa Cruz, CA, USA (21 Jul 1986).

Problems in intragalactic and intergalactic astrophysics are discussed in reviews and reports of recent observational and theoretical investigations. Topics addressed include stellar evolution in galaxies, small objects, galactic structure and dynamics, global parameters of galaxies, the relationship of galaxies to larger structures, distant galaxies, dark matter, galaxies before recombination, and

galaxies after recombination. Consideration is given to star formation in colliding and merging galaxies, the metallicity distribution of the extreme halo population, dwarf galaxies and dark matter, the effects of satellite accretion on disk galaxies, biased galaxy formation, and the formation and evolution of cosmic strings.

25281 **Formation and evolution of cosmic strings.** Albrecht, A. pp 367-377 of Nearly normal galaxies: from the Planck time to the present; Proceedings of the Eighth Santa Cruz Summer Workshop in Astronomy and Astrophysics, Santa Cruz, CA, July 21-Aug. 1, 1986. Faber, S.M. New York, NY; Springer-Verlag (1987). (CONF-8607362—).

From 8. Santa Cruz summer workshop in astronomy and astrophysics: nearly normal galaxies: from the Planck time to the present; Santa Cruz, CA, USA (21 Jul 1986).

The first step in the study of cosmic strings involves understanding the type of network that forms when the strings are first produced. The universe is treated as a large cube with periodic boundary conditions. The domains that form as Phi approaches the different minima of V are represented by smaller cubes that are stacked into the large one. In each domain, the value of Phi which is approached as the universe cools is chosen at random. A string will form on a domain edge if, when one moves around the four adjacent domain cubes, the corresponding Phi values move completely around the bottom of the Mexican hat. 14 references.

25282 **Supernova envelope shock origin of cosmic rays - a review.** Colgate, S.A. (Los Alamos National Lab., NM). *Advances in Space Research;* 4: No. 2-3, 367-379(1984).

The hydrodynamic shock origin of cosmic rays in the envelope of a Type I presupernova star is reviewed. The spectrum produced by the relativistic hydrodynamic shock is one power of E steeper than observed and so is unlikely to be the primary source of cosmic rays. On the other hand the possibility of accelerating ultrahigh energy particles to $\geq 10^{18}$ eV is unique to the shock mechanism and currently no other suggested galactic or extragalactic site is likely. The heavy nuclei are partially spalled in the shock transition and partially resynthesized in the postshock expansion for $E \leq 10^{18}$ eV dependent upon the large number of pairs in the post-shock fluid. Above this energy the shock progresses in the magnetized photosphere. The high energy limit is similarly ordered 10^{21} eV due to the coronal density of the presupernova star. The objection to SN shock accelerated cosmic rays by adiabatic deceleration is questioned on the basis of the Alfven wave scattering conditions. Ultrahigh energy particles escape because the wave excitation energy density is too low in the dimension of many Larmor radii necessary for scattering back to the SN remnant. Others escape if the energy density is too high. For all others between these two limits the immediately following matter of lower velocity and greater mass compresses and energizes previously trapped higher energy particles, allowing them to escape at energies still higher than originally shock ejected from the supernova.

6402 Atmospheric Physics

25283 **(CEA-CONF—9210) Non-linear wave front and ionization irregularities observed by HF sounding above a high power acoustic source.** Blanc, E.; Rickel, D. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Aug 1987. 28p. (In French). (CONF-8708217—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752224/JAW.

From 22. general assembly of the International Union of Radio Science; Tel Aviv, Israel (27 Aug 1987).

Different wave front with important nonlinearities were observed in ionosphere by a pulse HF sounding, at 38 km from the source point of a ground explosion (4800 T of ANFO). These wave front were materialized by partial reflections of sounding radio waves. A small scale irregular structure was set during about two minutes following a first wave front passage at the level of a sporadic E layer. These irregularities were observed also at the level of a second front in F region. Differently, a third front without irregularities could come from the lowest ionosphere layers or from a supersonic front which would propagate horizontally at the thermosphere base.

25284 **Radiative reactions and coherence modeling in the high-altitude electromagnetic pulse.** Vittitoe, C.N.; Rabinowitz, M. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, New Mexico 87185-5800). *Physical Review [Section] A: General Physics;* 37: No. 6, 1969-1977(15 Mar 1988).

A high-altitude nuclear electromagnetic pulse (EMP) with a peak field intensity of 5×10^4 V/m carries momentum that results in a retarding force on the average Compton electron (radiating coherently to produce the waveform) with magnitude near that of the geomagnetic force responsible for the coherent radiation. The retarding force results from a self-field effect. The Compton electron interaction with the self-generated magnetic field due to the other electrons accounts for the momentum density in the propagating wave; interaction with the self-generated electric field accounts for the energy-flux density in the propagating wave. Coherent addition of radiation is also quantitatively modeled.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 24885, 24953, 25408, 25496, 25533, 25599, 25607, 25683

25285 **(ATOMKI-B—21(1987)) Ion-induced Auger electron processes in gases.** Berenyi, Denes. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1987. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701788/JAW.

Submitted to NATO ASI Series B, (Plenum Press, New York).

A review is given on the ion-induced Auger electron processes in gases. The different channels of vacancy deexcitation in atoms are compared and the specific properties of Auger processes are emphasized. The physical quantities and concepts describing Auger processes are defined. Instrumentation for study of ion-induced Auger electron processes are briefly discussed. The experimental data, typical Auger spectra, evaluation methods and their results are described in the cases of Auger transitions in the target and in the projectile ion. (D.Gy.) 41 figs.; 3 tables.

25286 **(BNL—40744) Variable-energy positron studies on liquids and liquid-solid interfaces.** Throwe, J.; Lynn, K.G.; Gramsch, E.; Kanazawa, I. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 17p. (CONF-8706277—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006356/JAW.

From International symposium on positron annihilation studies of fluids; Arlington, TX, USA (8 Jun 1987).

A variable energy (<25keV) magnetically guided positron beam is being constructed for the study of liquid surfaces and solid-liquid phase transitions and interfaces. Positron beam design is discussed, with emphasis on special features necessary for the study of liquid and other high vapor pressure samples. Previous results are discussed, including measurements on amorphous metals and amorphous overlayers as well as measurements on bulk liquids. Experiments planned for the new beam will be presented. 23 refs., 6 figs.

25287 **(CONF-871246—2) What can Coulomb explosions teach us about clusters?.** Kanter, E.P.; Faibis, A.; Tack, L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88005979/JAW.

From International workshop on the structure of small molecules and ions; Neve Ilan, Israel (13 Dec 1987).

Although C_3^+ is considered to be the fundamental building block of the larger carbon clusters, the geometry of this molecule is unknown. Several authors have reported results of ab initio calculations in which the optimized geometry of the ion is deduced, assuming a linear configuration, in agreement with the structure of the neutral C_3 molecule. We report here the results of a series of measurements exploiting the Coulomb Explosion Method (CEM) to study the geometric structure of the C_3^+ ion. Our results indicate a cyclic structure for this ion. For comparison, measurements were also made of the carbon geometries of small hydrocarbon cations of the form $C_3H/sub\ n/^+$ (n = 1-4). Ring structures, of varying rigidi-

ties, are observed for all of these except $C_3H_4^+$ which exhibits a linear geometry. We also present results for doubly-charged species. 21 refs., 2 figs.

25288 **(CONF-8708164—7) Measurements of 2s-2p transition energies in helium-like and lithium-like nickel.** Zacarias, A.S.; Livingston, A.E.; Lu, Y.N.; Ward, R.F.; Berry, H.G.; Dunford, R.W. (Notre Dame Univ., IN (USA). Dept. of Physics; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005933/JAW.

From International conference on spectroscopy and structure of highly ionized atoms; Lisle, IL, USA (17 Aug 1987).

The wavelength of the fine structure transition $1s2s\ ^3S_1$ - $1s2p\ ^3P_2$ in Ni XXVII has been measured using fast-ion spectroscopy. The transition energy is sensitive to relativistic and Lamb shift corrections in this high-Z two-electron system. Comparison is made with measurements in other high-Z ions and with recent theoretical calculations. A preliminary measurement of the $1s^22s\ ^2S$/sub 1/2/ - $1s^22p\ ^2P$/sub 1/2/ find structure transition in Ni XXVI is also reported. 18 refs., 1 fig., 2 tabs.

25289 **(CONF-8709243—1) Coherence and correlations in fast ion-atom collisions.** Burgdoerfer, J. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 18p. NTIS, PC A03. Order Number DE88005856/JAW.

From Theory symposium: fundamental processes of atomic dynamics; Marata, Italy (21 Sep 1987).

This paper focusses on the description, classification and interpretation of coherent excitation of atomic or ionic systems with Coulombic two-body final state interactions. A group-theoretical approach is used to classify and interpret coherent excitation. The most significant result is that the state of excitation represented by a density operator can be mapped one to one onto expectation values of a set of operators. Examples are used to illustrate what can be learned about the collision process from investigations of coherent excitation. (JDH)

25290 **(DOE/ER/40093—T1-Vol.7) Physics through the 1990s: Atomic, molecular, and optical physics.** (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88006396/JAW.

This report was prepared by the Panel on Atomic, Molecular, and Optical Physics of the Physics Survey Committee in response to its charge to describe the field, to characterize the recent advances, and to identify the current frontiers of research. Some of the areas discussed are: atomic structure, atomic dynamics, accelerator-based atomic physics, molecular photoionization and electron-molecule scattering, astrophysics, laser spectroscopy, atmospheric physics, plasma physics, and applications.

25291 **(IC—86/251) Self energy corrections to the "ab initio" band structure: Chromium.** Kulikov, N.I.; Magnitskaya, M.V.; Alouani, M.; Khan, M.A. (Institute of High Pressure Physics, AN SSSR, Troitsk (USSR)). (International Centre for Theoretical Physics, Trieste (Italy)). May 1987. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701825/JAW.

We describe the effect of many particle corrections to improve the electronic energy spectrum calculated in the framework of the Density Functional Formalism (DFF). We show that it is possible to consider an n particle diagram like a correction to the DFF results for electronic structure, if we take into account the electron-electron interaction with non-zero transmitted momentum q or energy ϵ. The model is proposed for calculating the leading term of the self-energy expansion as a power series in interactions, i.e. the second order term under the conditions q=O and ϵnot =O. This model is illustrated by calculating the electronic band structure and optical properties of anti ferromagnetic chromium. The self-energy correction leads to a better agreement between the theoretical calculations and experimental measurements of electronic properties. (author). 40 refs, 5 figs, 3 tabs.

25292 **(IC—86/332) On selection rules and inelastic electron scattering at intermediate energies.** Nuroh, K. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701833/JAW.

Correlation effects are included in the Bethe-Born theory for the generalized oscillator strength of inelastic scattering of electrons on atoms. The formulation is such as to allow for the calculation of relative line strengths of multiplets. It is used to analyze line strengths of the 4d -> 4f transition in La/sup 3+/ and Ce/sup 4+/ within LS-coupling. The analysis indicates that only singlet states of the intermediate 4d/sup 9/4f configuration are allowed. Calculated line strengths are compared with a recent core electron energy loss spectra of metallic La and tetravalent CeO/sub 2/ and there is an overall qualitative agreement between theory and experiment. (author). 11 refs, 4 figs, 2 tabs.

25293 **(IC—86/373) Resonance fluorescence spectra of a three-level atom driven by two strong laser fields.** Peng Jinsheng. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701842/JAW.

The resonance fluorescence of a three-level atom interacted with two high-power laser fields is investigated in strong field approximation. The fluorescence distribution is obtained by means of the theory of dressing transformation. (author). 15 refs, 2 figs.

25294 **(IC—87/133) Coherent rotational states their formation and detection.** Fonda, L.; Mankoc-Borstnik, N.; Rosina, M. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 92p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701875/JAW.

In this paper, we describe molecules and nuclei, with energy spectrum close to that of an ideal rotor, and therefore capable of being pushed into a coherent rotational state. The formation of a coherent rotational state is obtained by means of a strong electromagnetic pulse. In the case of a molecule, resort is made to a laser pulse, while for a nucleus use is made of the Coulomb excitation in a heavy ion collision. The latter is a thought experiment in that the "coherence" period obtained in the evolution of typical observables is out of reach of experimental detection. For the molecular case, the experiment is feasible and has been done. (author). 32 refs, 13 figs, 5 tabs.

25295 (INIS-mf—10839, pp 913-915) **Study of the mercury hydride molecule kinetics in a HF discharge for a potential HgH laser.** Kolbychev, G.V.; Kolbycheva, P.D. (AN SSSR, Tomsk. Inst. Optiki Atmosfery). Jun 1985. NTIS (US Sales Only), PC A99/MF A01. Order Number DE87701822/JAW. (CONF-850718—Vol.2).

From 17. international conference on phenomena in ionized gases; Budapest, Hungary (8 Jul 1985).

Experimental study on physical-chemical processes responsible for production, quenching and breakdown of HgH molecules in A/sup 2/PI/sub 1/2/ and CHI/sup 2/Σ/sub 1/2/ states in Hg+H/sub 2/+He(N/sub 2/,CO) high-frequency discharge plasma is reported. Production channels for HgH(A) are revealed, where the HgH(X) ground state is skipped. The latter is destructed in the chemical reaction with CO molecules. Rate constants for a few quenching processes involved are given. Radiation absorption by a discharge plasma was measured and the effect of N/sub 2/ and CO admixtures was studied. The experimental results obtained were compared with the authors' earlier theoretical model for a HgH laser. 3 refs.; 3 figs.

25296 (INP—1268/PL, pp 74-129) **Quasimolecular heavy ion-atom collisions.** Mokler, P.H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

A few selected points to the X-ray field which show in some cases deviations from the general understanding of inner shell excitation in superheavy collision systems or which are not so well

known are presented. Examples for characteristic and quasi-molecular X-ray emission for systems around Z1 + Z2 ~ 160 are given. The first measurements of the 2pσ excitation in gases are presented. In order to do such studies effectively a new method was introduced, in which highly charged projectiles are produced by foil stripping at high energies and successive deceleration. The charge state dependence of the X-ray emission is discussed for systems with Z1 + Z2 ~ 110. 43 refs., 32 figs., 2 tabs.

25297 **(KU-HCOE-FL2-R—85-24) Direct excitation in heavy atom collisions: A propensity rule for charge cloud orientation.** Andersen, N.; Nielsen, S.E. (Paris-11 Univ., 91 - Orsay (France). Lab. de Collisions Atomiques et Moleculaires; Aarhus Univ. (Denmark). Inst. of Physics; Copenhagen Univ. (Denmark). Kemisk Lab. 3; Royal Danish School of Pharmacy, Copenhagen). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Aarhus Univ. (Denmark). Inst. of Physics). 1985. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752679/JAW.

The Massey Criterion prescribes maximum electronic excitation of atoms in heavy particle collisions for collision velocities v where Δε a/Planck constantv ≅ π. Here Δε is the energy defect and a is the effective interaction length. Experiments with planar symmetry have revealed a preferred way of rotation of the excited charge cloud in this velocity region. We demonstrate by analysis of a simple, yet realistic model why excitation favors states with a specific orientation. A general propensity rule is derived and its validity evaluated for a specific case, the Na-He system. Implications for future experiments are pointed out. In particular, the propensity rule predicts very different collisions behaviors of oppositely oriented atoms, as prepared e.g. by circular polarized laser light.

25298 **(KU-HCOE-FL2-R—86-16) Confirmation of propensity rule for charge cloud orientation: Mg/sup +/(3s -> 3p/sub +-1/) excitation in 1-60 keV Mg/sup +/-He, Ar collisions.** Panev, G.S.; Andersen, T.; Dalby, P.; Andersen, N.; Nielsen, S.E. (Aarhus Univ. (Denmark). Inst. of Physics; Aarhus Univ. (Denmark). Inst. of Physics; Copenhagen Univ. (Denmark). Fysisk Lab. 2; Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry AD). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Aarhus Univ. (Denmark). Inst. of Physics; Aarhus Univ. (Denmark). Inst. of Physics). 1986. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752681/JAW.

A recently proposed propensity rule for charge-cloud orientation in heavy-atom collisions is investigated experimentally. The scattered particle-polarized photon coincidence technique is used to study the excitation probability and electronic angular momentum of Mg/sup +/ ions undergoing 3s -> 3p excitation in single collisions with He or Ar and impact parameters of typically 1-2 a.u. The 1-60 keV impact-energy range includes the region of maximum probability. The propensity rule is here strikingly confirmed and its range of validity illuminated.

25299 **(KU-HCOE-FL2-R—86-17) Propensity rules for orientation by atom impact. Pt. 1. Three-state description of direct S<->P transitions.** Andersen, N.; Nielsen, S.E. (Aarhus Univ. (Denmark). Inst. of Physics; Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry AD). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Aarhus Univ. (Denmark). Inst. of Physics). 1986. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752682/JAW.

P state orientation and alignment created in direct, collision-induced S reversible P transitions of a quasi-one-electron atom are analyzed in the natural coordinate frame. In the velocity region of maximum transition probability, propensity rules for the orientation are derived, and their range of validity in impact parameter and velocity is discussed. The predictions are tested and illustrated by three-state calculations for (Na(3s reversible 3p) transitions in Na-He collisions.

25300 **(KU-HCOE-FL2-R—86-18) Propensity rules for orientation by atom impact. Pt. 2. Many-state description of direct transitions.** Nielsen, S.E.; Andersen, N. (Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry AD; Aarhus Univ. (Denmark). Inst. of Physics). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Aarhus Univ. (Denmark). Inst. of Physics). 1986. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752683/JAW.

This paper contains a theoretical analysis of orientation and alignment created in direct, collision-induced transitions among atomic states with arbitrary angular momentum. Using the natural coordinate frame, general propensity rules are derived in the velocity region of maximum transition probability and their range of validity is investigated. The predictions are tested and illustrated by nine-state calculation for Li(n=2,3) transitions in Li-He collisions.

25301 **(KU-HCOE-FL2-R—86-19) Orientation and alignment of Mg/sup +/ (3p) states excited in 1-60 keV collisions with He and Ar.** Panev, G.S.; Andersen, N.; Andersen, T.; Dalby, P. (Aarhus Univ. (Denmark). Inst. of Physics). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Aarhus Univ. (Denmark). Inst. of Physics). 1986. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752684/JAW.

The orientation and alignment of Mg/sup +/(3p) states created in 1-60 keV Mg/sup +/(3s)-He,Ar collisions have been studied by the polarized photon-scattered particle coincidence technique at scattering angles corresponding to impact-parameter ranges of 0.5-1.0 a.u. (He) and 1.2-2.0 a.u. (Ar). Referring to the standard geometry, in the region of maximum excitation probability (≅ 35 keV), a strong propensity for population of the Mg/sup +/(3p/sub -1/) state is observed. The propensity breaks down when going towards lower energies, and for collisions with He even a transient reversal of the angular momentum occurs. The alignment angel varies little in the entire range of impact parameters and energies investigated. These observations compare well with recent general predictions of Andersen and Nielsen.

25302 **Titanium core-level spectra in titanium tetrahalide molecules.** Veal, B.W.; Lee, K.; Ellis, D.E. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439-4843). *Physical Review [Section] A: General Physics;* **37**: No. 6, 1839-1846(15 Mar 1988). Contract W-31-109-ENG-38.

Molecular-orbital calculations of TiF_4, $TiCl_4$, $TiBr_4$, and TiI_4 molecules have been made with use of self-consistent local-density theory with the discrete variational (DV-Xα) method. Core-level excitation energies corresponding to x-ray photoelectron spectroscopy (XPS) measurements are calculated. Spectral peaks associated with metastable final states of the core ionized atom that include relaxation and charge transfer processes are calculated. XPS spectra of Ti core levels in these compounds show that binding energies of both main lines and satellites clearly depend on the ligated anion. The observed systematic behavior of ionization potentials and satellite separation energies for the halide series is calculated with reasonable accuracy. With use of the single-determinant formalism, contributions to the intensity of the main line and satellites are examined.

25303 **Measurement of weak branching out of the (near-) two-level system Ba 6s6p $^1P_1$left-right-arrow6s^2 $^1S_0$.** Gerke, G.K.; Bushaw, B.A. (Pacific Northwest Laboratory, Richland, Washington 99352). *Physical Review [Section] A: General Physics;* **37**: No. 5, 1502-1506(1 Mar 1988). Contract AC06-76RL01830.

Weak branching out of the 6s^2 $^1S_0$left-right-arrow6s6p $^1P_1$ two-level system to the metastable 6s5d /sup 1,3/D states has been measured for /sup 138/Ba using cw-resonance ionization mass spectrometry on an optically pumped atomic beam. A branching ratio (inverse branching fraction) of 440 +- 40 was obtained.

25304 Z dependence of atomic parameters for selected autoionizing states of two-electron ions. Karim, K.R.; Bhalla, C.P. (Department of Physics, Kansas State University, Manhattan, Kansas 66506). *Physical Review [Section] A: General Physics;* **37**: No. 5, 1507-1511(1 Mar 1988).

X-ray and Auger transition rates from doubly excited $2p^2\ ^1D_2$, $2s^2\ ^1S_0$, $2p3p\ ^1D_2$, $2p^2\ ^3P_2$, and $2p4d\ ^1F_3$ states of heliumlike ions are presented for Z = 10, 14, 18, 20, 22, 24, 26, and 28. Intensity factors of x-ray satellites originating from dielectronic recombination of ground-state hydrogenic ions via the above autoionizing states are also calculated. The calculations are performed in the intermediate-coupling scheme with the inclusion of configuration interaction using the Hartree-Fock-Slater atomic model.

25305 Chaos and incoherence in a classical rotation-vibration model of infrared multiple-photon excitation. Ackerhalt, J.R.; Milonni, P.W. (Theoretical Division T-12, Mail Stop J569, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **37**: No. 5, 1552-1562(1 Mar 1988).

By including rotations in a previously developed generic vibrational model of ir multiple-photon excitation (MPE) [Phys. Rev. Lett. 51, 1259 (1983) and Phys. Rev. A 34, 1211 (1986)] it is found that the combination of chaotic dynamics and rotational averaging leads to fluence-dependent absorption and removes the sensitivity of the results to model-dependent parameters. Therefore, a complete propagation calculation through a molecular medium of this type would show a Beer's law absorption of photons consistent with the vast majority of MPE experiments performed to date, a result which previously was attributed to rate-equation dynamics in the molecular quasicontinuum. In addition, the classical rotation-vibration dynamics observed in this model correlate very well with one's quantum intuition based on a molecule's P-, Q-, and R-branch structure and on the red shift of the vibrational absorption feature with excitation.

25306 Temporal evolution of ion energy in a plasma focus. Rhee, M.J.; Weidman, D.J. (Electrical Engineering Department and Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **31**: No. 3, 703-705(Mar 1988).

For the first time, the temporal structure of ion energy in a plasma focus is revealed using a time-resolving Thomson spectrometer. The velocities and arrival times of ions are determined from the spectrogram. The resulting distribution of ions in velocity—time space at the source is found to be a line distribution, as if the ions were accelerated in a diode by a pulsed voltage.

25307 Spectra and energy levels of Sm XXXIV, Eu XXXV, Gd XXXVI, and Yb XXXXII. Doschek, G.A.; Feldman, U.; Brown, C.M.; Seely, J.F.; Ekberg, J.O.; Behring, W.E.; Richardson, M.C. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C. 20375-5000). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 2, 243-246(Feb 1988).

We present wavelengths and energy levels based on extreme-ultraviolet and x-ray transitions in the ions Sm/sup @//sup m+33/, Eu/sup @//sup m+34/, Gd/sup @//sup m+35/, and Yb/sup @//sup m+41/ of the Cu I isoelectronic sequence. The sources of the spectra were laser-produced plasmas generated by the OMEGA laser facility at the University of Rochester's Laboratory for Laser Energetics. The photographic spectra were recorded by a 3-m grazing-incidence spectrograph. The spectral lines fall between about 10 and 115 ξA, and we compare our results with previous measurements where available.

25308 Inner-shell radiation for ion beam diagnostics. Burns, E.J.T.; Bailey, J.E.; Dukart, R.J.; Mehlhorn, T.A. (Sandia National Labs., Albuquerque, NM 87185). pp 75 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—). Contract AC04-76DP00789.

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

X-rays from inner-shell ionization are present in all ion-atom collisions where the velocity of the ion projectile is comparable to the velocity of the inner-shell orbital electron in the target. In this paper we discuss the use of inner shell radiation to diagnose lithium beam parameters. These parameters include the ion energy, ion current, and ion beam power or energy density on target using the PBFA II accelerator. For heavier ions such as lithium, the cross sections for inner-shell x-ray production scale as the ion energy per unit mass and the square of the atomic number of the projectile. As the mass of the incident projectile increases, the cross section for multiple inner-shell ionization also increases. This may shift the most intense x-ray transitions to higher energies. In addition, as the lithium ion density on target increases, outer shell electrons will be ionized as well. Ultimately, the high energy portion of a thermal electron distribution can compete with certain ion induced inner-shell ionizations. Sorting out all the possible transitions requires high resolving power (E/ΔE—10/sup 3/).

25309 γ-ray initiated chain decomposition of aqueous ozone solutions. Hart, E.J.; Sehested, K.; Bjergbakke, E.; Holcman, J. (Argonne National Lab., Argonne, IL 60439). pp 69 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

The free radical initiated chain decomposition of aqueous O/sub 3/-O/sub 2/ solutions was studied as a function of dose rate and O/sub 3/ concentration in the pH range, 2.0-7.0. At dose rates of 10 rads/s or less extensive chain decomposition of O/sub 3/ occurs. Under these conditions impurities arising from the water, glassware, O/sub 3/, acids and buffers suppress decomposition. In the absence of impurities, the decomposition rate is 1st order in O/sub 3/ concentration in the range from 50-200 1M and achieves chain lengths of 200 to 300. A typical decomposition curve is autocatalytic, with a low initial rate, a rapid middle rate and, as the O/sub 3/ concentration approaches zero, a slow final rate. These complexes decay curves have been analyzed by measuring the decomposition rates at 50,30 and 15% of the initial O/sub 3/ concentration. The yields per 100 μM O/sub 3/ increase with increasing pH to a broad maximum at pH 4.0 and thereafter decline slightly. The propagation reactions in this chain mechanisms are: O/sub 3/+O/sub 2/-bar →O/sub 3-bar/+O/sub 2/; O/sub 2-bar/+H/sup +/ =O/sub 2/+OH; OH+O/sub 3/ → O/sub 2/; HO/sub 2/=H/sup +/+O/sub 2/. The termination reactions are: HO/sub 2/+OH →H/sub 2/O+O/sub 2/ (dominant at low pH; OH+OH →H/sub 2/O/sub 2/ (dominant at pH>4); OH+X →XOH (dominant with X as an impurity). The decay curves may be simulated by the water radiolysis mechanism including the above reactions. The overall behavior of the system conforms to an impurity level with kc's in the range of 10-100s/sup -1/. For example, at an impurity level with kc's in the range of 1.0x10/sup -6/M(x) and a rate constant of 10/sup 8/M/sup -1/s/sup -1/, kc=100 s/sup -1/.

25310 Dielectric relaxation and electron solvation. Mozumder, A. (Radiation Lab., Univ. of Notre Dame, Notre Dame, IN 46556). pp 69 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Following initial trapping electron solvation in a polar liquid is described using a Debye model of dielectric relaxation, but including the dielectric friction on the orientation of the polar molecules according to the theory of Nee and Zwanzig. Retarded diffusion equation for the angular distribution of dipoles is derived and solved approximately. In the outer regions the Legendre coefficients are uncoupled and decay exponentially except P/sub α/. In the inner region they are coupled and grow and decay in a complicated manner. Results are compared with experiment and also with those obtained in the Eyring model.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 24064

25311 **(IC—87/134) Magnetohydrodynamic squeeze film.** Hamza, E.A. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701876/JAW.

The motion of an electrically conducting fluid film squeezed between two parallel disks in the presence of a magnetic field applied perpendicular to the disks is studied. Analytic solutions through use of a regular perturbation scheme are obtained. The results show that the electromagnetic forces increase the load carrying capacity considerably. (author). 5 refs, 10 figs, 3 tabs.

25312 **(NUREG/CR—5065) Time- and volume-averaged conservation equations for multiphase flow using mass-weighted velocity and internal energy.** Sha, W.T.; Chao, B.T.; Soo, S.L. (Argonne National Lab., IL (USA)). Jan 1988. Contract W-31109-ENG-38. 80p. (ANL—87-51). NTIS, PC A05/MF A01 - GPO. Order Number TI88006060/JAW.

Conservation equations of mass, momentum, and energy for multiphase flow, formulated on the basis of local volume averaging followed by time-averaging for turbulent flows, are presented. They are differential equations of transport with area integrals associated with interfacial transport. Because the spatial averaging theorems used in the analysis are subject to certain length scale restrictions, the resulting equations are best suited for dispersed systems. The local instantaneous variable is decomposed as a linear combination of its local intrinsic volume average and a spatial deviation. Use of the mass-weighted, volume-averaged velocity and internal energy simplified certain relationships between the volume average of products and the product of volume averages. Recognition of the fact that the spatial deviation component takes on positive and negative values within the averaging volume makes further simplifications feasible. Inasmuch as information is always lost as a result of averaging, be it volume-averaging or time-averaging or both, the lost information must somehow be replaced before the equations can be solved. This is commonly done by the development of appropriate constitutive relations, which, however, is not treated in this report. 28 refs.

25313 **Dynamics of bubble growth for Rayleigh—Taylor unstable interfaces.** Gardner, C.L.; Glimm, J.; McBryan, O.; Menikoff, R.; Sharp, D.H.; Zhang, Q. (Departments of Mathematics and Computer Science, Duke University, Durham, North Carolina 27706). *Physics of Fluids;* **31**: No. 3, 447-465(Mar 1988).

A statistical model is analyzed for the growth of bubbles in a Rayleigh—Taylor unstable interface. The model is compared to solutions of the full Euler equations for compressible two phase flow, using numerical solutions based on the method of front tracking. The front tracking method has the distinguishing feature of being a predominantly Eulerian method in which sharp interfaces are preserved with zero numerical diffusion. Various regimes in the statistical model exhibiting qualitatively distinct behavior are explored.

25314 **Chaotic advection in pulsed source—sink systems.** Jones, S.W.; Aref, H. (Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California 92093). *Physics of Fluids;* **31**: No. 3, 469-485(Mar 1988).

The onset of chaos in passive advection of particles by flow caused by a pulsed source—sink system is documented. This type of model is of interest in various applications. It is of fundamental interest as the first example of a flow without circulation about any contour at any instant displaying chaotic particle paths. Standard chaos diagnostics such as Poincare sections and Lyapunov exponents are studied as are more conventional flow visualization measures such as streaklines. Numerical stirring experiments for various collections of particles are performed and the properties of a certain one-dimensional map induced by the two-dimensional flow are examined.

25315 **Couette flow of a binary gas mixture.** Valougeorgis, D. (Department of Mathematics and Center for Transport Theory and Mathematical Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *Physics of Fluids;* **31**: No. 3, 521-524(Mar 1988).

The linearized binary model described by Hamel [Phys. Fluids 8, 418 (1964)] is used to obtain a set of kinetic equations and boundary conditions for the Couette flow problem. The derived set of two coupled integrodifferential equations is solved by iteration implementing standard discretization techniques. Highly accurate numerical results are presented for the mass velocity distribution and the total shear stress of the binary gas system.

25316 **Moment problem formulation of the simplified ideal magnetohydrodynamics ballooning equation.** Handy, C.R.; Bessis, D.; Williams, R.M. (Department of Physics, Atlanta University, Atlanta, Georgia 30314). *Journal of Mathematical Physics (New York);* **29**: No. 3, 717-720(Mar 1988).

A fundamentally new method for determining the eigenvalues of linear differential operators is presented. The method involves the application of moment analysis and affords a fast and precise numerical algorithm for eigenvalue computation, particularly in the intermediate and strong coupling regimes. The most remarkable feature of this approach is that it provides exponentially converging lower and upper bounds to the eigenvalues. The effectiveness of this method is demonstrated by applying it to an important magnetohydrodynamics problem recently studied by Paris, Auby, and Dagazian [J. Math. Phys. 27, 2188 (1986)]. Through the very precise lower and upper bounds obtained, this approach gives full support to their analysis.

6450 High Energy Physics

25317 **Clustering with local equivalence relations.** Yousef, S. (Florida State Univ., Tallahassee). pp 423-426 of Computing in high energy physics. Ash, W. (ed.). Amsterdam, The Netherlands; North-Holland Physics Publishing (1987). Contract FC05-85ER25000.

From Computing high energy physics; Pacific Grove, CA, USA (2 Feb 1987).

A family of algorithms for clustering elements of a detector associated with a particle or jet is introduced. The algorithms are based on local clustering with equivalence relations. The conceptual and practical advantages of these algorithms are discussed. Timing information is given for scalar computers and vector pipeline supercomputers. 9 references, 2 figures.

6451 Particle Interactions And Properties - Experimental

25318 **(DESY—87-001) Observation of inclusive D/sub S/ production in B meson decay.** Albrecht, H.; Binder, U.; Boeckmann, P.; Glaeser, R.; Harder, G.; Lembke-Koppitz, I.; Schmidt-Parzefall, W.; Schroeder, H.; Schulz, H.D.; Wurth, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.); Dortmund Univ. (Germany, F.R.). Inst. fuer Physik; Heidelberg Univ. (Germany, F.R.). Inst. fuer Hochenergiephysik; Carleton Univ., Ottawa, Ontario (Canada); Atomic Energy Commission, Tokyo (Japan); McGill Univ., Montreal, Quebec (Canada)). Jan 1987. 14p. Also published in Phys. Lett., B (26 Mar 1987) Vol. 187(3/4) p. 425-430.

Using the ARGUS detector at the e/sup +/e/sup -/ storage ring DORIS II, we have observed inclusive D/sub S/ production, using the channel D/sub S//sup -/ -> phiπ/sup -/, in decays of B mesons produced on the Y(4S). The product of branching ratios BR(D -> D/sub S/X).BR(D/sub S//sup -/ -> phiπ/sup -/) is (4.2+-0.9+-0.6)x10/sup -3/. The D/sub S/ momentum spectrum suggests a substantial two-body component to the final states of B -> D/sub S/X decays.

25319 (DOE/ER/40093—T1-Vol.6) Physics through the 1990s: Elementary-particle physics. Kirk, W.T. (ed.). (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 247p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88006395/JAW.

This report on elementary-particle physics is part of an overall survey of physics carried out for the National Academy of Sciences by the National Research Council. The panel that wrote this report had three goals. The first goal was to explain the nature of elementary-particle physics and to describe how research is carried out in this field. The second goal was to summarize our present knowledge of the elementary particles and the fundamental forces. The third goal was to consider the future course of elementary-particle physics research and to propose a program for this research in the United States. All of these goals are covered in this report.

25320 (FNAL/Pub—87/223-A-Rev.) Limits to the radiative decays of neutrinos and axions from γ-ray observations of SN 1987A. Kolb, E.W.; Turner, M.S. (Fermi National Accelerator Lab., Batavia, IL (USA); Chicago Univ., IL (USA). Enrico Fermi Inst.). Feb 1988. Contract AC02-76CH03000. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006995/JAW.

Using γ-ray observations made by the Solar Maximum Mission Gamma Ray Spectrometer in the energy range 4.1 to 6.4 MeV we limit the possible radiative decays of neutrinos and axions emitted by SN 1987A. For neutrinos less massive than about 20 eV our constraint is tau/sub nu//m/sub nu/ greater than 1.7 x 10^{15} B/sub γ/ sec/eV; and for masses between 20 and 275 eV our constraint is tau/sub nu/ greater than 3.4 x 10^{16} B/sub γ/γ/sub GRS//sup -1/2/ sec, where B/sub γ/ is the branching ratio for the radiative decay mode and γ/sub GRS/ is the yet undetermined instrument background count rate in units of 0.1 sec^{-1}. The first limit is some 2 orders-or-magnitude better than the previous limit based upon the integrated γ-ray flux from all supernovae. The axion limit is less interesting: m/sub α/ less than 55γ/sub GRS//sup 11/94/ eV. 15 refs.

25321 (INIS-mf—11101) Formation of resonances with final state photons in two photon interactions, and development of calorimetric techniques. Mir, R. (Weizmann Inst. of Science, Rehovoth (Israel)). Jul 1986. 139p. NTIS (US Sales Only), PC A07/MF A01. Order Number TI88701931/JAW.

Contains an annotated bibliography of 122 references.

In this thesis, resonances produced in two photon interactions were investigated with the TASSO detector at PETRA. The eta/sup '/ and A/sub 2/ resonances were studied in a final state of charged pions and low energy photons. The couplings of these resonances to γγ were measured: Γ/sub γγ/(eta/sup '/(958)) 5.1+-0.4(stat.)+-0.65(syst.) Kev, Γ/sub γγ/(A/sub 2/(1320)) 0.90+-0.27(stat.)+-0.16(syst.) Kev. A search for iota(1460) and eta/sub c/(2980) was initiated. Upper limits on the γγ widths of these resonances times their branching ratio to the decay channel were obtained: Γ/sub γγ/(iota->γγ) x B(iota->rho/sup 0/γ) < 0.54 keV (95% C.L.), Γ/sub γγ/(eta/sub c/->γγ) x B(eta/sub c/->eta/sup '/π/sup +/π/sup -/) < 2.6 keV (95% C.L.). A proportional tubes electromagnetic calorimeter operating in the proportional mode was constructed. Tower readout was incorporated. The calorimeter gave an energy resolution of σ/E = 19%/√E. Large surface, thin Gap Chambers (TGC), were developed and constructed for the OPAL hadron pole-tip-calorimeter. The TGC operate in a high gain mode. They provide large signals for both pad and strip readout, without the need for amplification. To form a hadron calorimeter, ten chambers were interlaced with 8 cm thick iron slabs between them. An energy resolution of: σ/E = 105%/√E was obtained.

25322 (INP—1268/PL, pp 210-226) Observation of intermediate bosons. Rybicki, K. (Institute of Nuclear Physics, Krakow (Poland)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

A short review of the weak interactions mediated by intermediate vector bosons possibilities of identification and properties of W/sup +-/, Z/sup 0/ are given. The results and perspectives of CERN SPS Collider, UA1 and UA2 experiments are presented. (M.F.W.).

25323 (LBL—22300, pp 100-105) An experiment to measure the multiple Coulomb scattering of heavy charged particles. Wong, M.; Schimmerling, W.; Ludewigt, B.A.; Phillips, M.H.; Frank, R.; Curtis, S.B.; Tobias, C.A.; Walton, J.T.; Sommer, H.A.; Landis, D.A. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

We report on an experiment designed to measure the multiple Coulomb scattering of heavy charged particles at high energy. A particle traversing a target undergoes multiple collisions, which result in deflection of the path of the particle from its original course. This multiple scattering leads to the spreading of a beam of particles as it traverses materials, and increases the beam divergence. A consequence of such scattering is that for any single particle incident on a target, it will emerge from the target along a trajectory somewhat deflected from its original one. The aim of this experiment is to measure this deflection. Also measured is the lateral displacement of the particle before and after scattering. Thus far experiments have been performed for beams of neon, iron, and uranium ions scattered in targets of aluminum, copper, lead, and water. 5 figs., 1 tab.

25324 (MPI-PAE/Exp.El.—186) New results on hadron production in lepton-nucleon and lepton-nucleus scattering. Schmitz, N. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Oct 1987. 25p. (CONF-8709152—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752043/JAW.

From 18. international symposium on multiparticle dynamics; Tashkent, USSR (8 Sep 1987).

New results on leptoproduction of hadrons are reviewed. The topics are: Transverse momenta and jets; charm production; dileptons in νN, anti νN scattering; test of PCAC, shadowing; coherent rho/sup +-/ production on nuclei; production of resonances.

25325 (SLAC-PUB—4410) Experimental review of J/psi decays. Toki, W.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1987. Contract AC03-76SF00515;AC02-76ER01195;AC03-81ER40050. 36p. (CONF-8706185—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004380/JAW.

From Charm physics symposium; Beijing, China (4 Jun 1987).

This is a review of J/psi physics from e^+e^- colliders presented at the Charm Workshop in Beijing, China. The review includes a brief historical summary of J/psi physics, a general discussion of theoretical models and detailed results on radiative and hadronic J/psi decays from the Mark III, DM2, Crystal Ball and MARK II groups. 119 refs., 13 figs., 10 tabs.

25326 Radiochemical neutrino detection via /sup 127/I(ν/sub e/,e^-)/sup 127/Xe. Haxton, W.C. (Institute for Nuclear Theory, Department of Physics, FM-15, University of Washington, Seattle, Washington 98195). *Physical Review Letters;* **60**: No. 9, 768-771(29 Feb 1988).

Solar or supernova neutrinos incident on an iodine-bearing liquid will produce the noble gas /sup 127/Xe (tau/sub 1/2/ = 36.4 d), which can be recovered and counted as in the present /sup 37/Cl experiment. The rate of neutrino reactions per unit volume of detector could be more than an order of magnitude greater than in perchloroethylene. I discuss the new physics that might be learned from such an experiment.

25327 Neutral mesons which decay into 4π/sup 0/. Alde, D.; Knapp, E.A.; Binon, F.G.; Bricman, C.; Lagnaux, J.P.; Mouthuy, T.; Stroot, J.P.; Donskov, S.V.; Inyakin, A.V.; Kachanov, V.A. (Los Alamos National Lab., NM (USA); Interuniversity Inst. for High Energies, Brussels (Belgium)). *Physics Letters [Section] B;* **198**: No. 2, 286-291(19 Nov 1987).

Data on the 4π/sup 0/ decay mode of mesons have been obtained in a search for glueballs performed at the CERN SPS with the GAMS-4000 multiphoton spectrometer. A new tensor glueball candidate X(1810) appears as a clear peak in the 4π/sup 0/ mass spectrum. The 4π/sup 0/ decay of G(1590) is also observed. The measured value of BR(G -> 4π/sup 0/)/BR(G -> etaeta) = 0.8 +- 0.3 further supports the glueball assignment of this scalar particle. The rare decay of f(1270) into 4π/sup 0/ has been measured: BR(f -> 4π/sup 0/) = (3 +- 1) x 10/sup -3/.

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REFER ALSO TO CITATION(S) 25363, 25364, 25371, 25374, 25384, 25463

25328 (AECL—8440) Details of the general numerical solutions of the Friedberg-Lee soliton model for ground and exited states. Koeppel, T.; Harvey, M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1984. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701783/JAW.

A new numerical method is applied to solving the equations of motion of the Friedberg-Lee Soliton model for both ground and spherically symmetric excited states. General results have been obtained over a wide range of parameters. Critical coupling constants and critical particle numbers have been determined below which soliton solutions cease to exist. The static properties of the proton are considered to show that as presently formulated the model fails to fit all experimental data for any set of parameters.

25329 (DESY—87-010) Gluonium spectrum in QCD. Dominguez, C.A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1987. 51p. (CONF-8702125—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752228/JAW.

From Cape Town workshop on quarks, gluons and hadronic matter; Cape Town, South Africa (16 Feb 1987).

The scalar (0/sup ++/) and the tensor (2/sup ++/) gluonium spectrum is analyzed in the framework of QCD sum rules. Stable eigenvalue solutions, consistent with duality and low energy theorems, are obtained for the mass and width of these glueballs.

25330 (IC—86/226) Semi-empirical formula for the leptonic width of vector mesons. Song Xiaotong. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701822/JAW.

We suggest a semi-empirical formula for the leptonic width of vector mesons. The agreement with the data is very good not only for the ground state J/sup PC/=1/sup --/ mesons (rho, ω, phi, J/psi and γ) but also for the excited /sup 3/S/sub 1/ states of cc-bar and bb-bar families. (author). 12 refs, 3 tabs.

25331 (IC—86/394) CP violation of higher generation of quarks. Pal, B.K. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701853/JAW.

We predict CP violation in fourth generation of quarks using experimental constraints on the quark mixing that proceeds mainly between neighbouring families, while the mixing between far off families is very small. Also the nature of tau/sub b/ and tau/sub b/, is discussed. (author). 11 refs.

25332 (IC—87/156) Large B/sup O/-B-bar/sup O/ mixing and physics of the heavy t-quark. Fadin, V.S.; Khoze, V.A.; Uraltsev, N.G. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki; International Centre for Theoretical Physics, Trieste (Italy); AN SSSR, Leningrad. Inst. Yadernoj Fiziki). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701898/JAW.

We discuss some implications of large B/sup O/-B-bar/sup O/ mixing observed recently by ARGUS collaboration. Main attention is paid to the physics of heavy t-quark. (author). 15 refs.

25333 (IC—87/158) Neutrino magnetic moment and the solar neutrino problem. Barut, A.O.; Bozic, M. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701900/JAW.

For a relativistic particle of mass m, energy E and anomalous magnetic moment μ, the spin-flip angle in a magnetic field B after a length L is phi=(2μBL)/hc((mc/sup 2/)/E) in ultrarelativistic limit. Contrary to recent assertions, a magnetic moment of μ=10/sup -10/μ/sub O/ for the neutrino cannot solve the solar neutrino puzzle by spin-flip in a simple way. The reflection coefficient and other possible effects are also discussed. (author). 11 refs.

25334 (IN2P3—87-01-Vol.1) Vol. 1: Physics beyond the TEV range. Altarelli, G.; Aurenche, P.; Degrange, B.; Peccei, R.D.; Renard, F.M.; Perrottet, M.; Savoy, C. (eds.). (Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France)). 1987. 374p. (In French and English). (CONF-8509292—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752226/JAW.

From 17. summer school of particle physics; Clermont-Ferrand, France (9 Sep 1985).

In this session on the physics beyond the TeV the theoretical forecasts and their manifestation in this new energy range are reviewed.

25335 (IN2P3—87-01-Vol.1, pp 1-44) Beyond the standard model. Altarelli, G. (Rome Univ., Italy). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752226/JAW. (CONF-8509292—).

From 17. summer school of particle physics; Clermont-Ferrand, France (9 Sep 1985).

The standard model correctly describes all established experimental facts. Yet, on one hand its verification is not complete, especially in the Higgs sector. On the other hand there is a general consensus that the standard model cannot be a complete description of physics all the way up to the energy scale where quantum gravity effects let in. Compelling arguments can be given that new physics must be found in the TeV energy region. There are many different ideas on what the new physics could be. Some important indications can be obtained from the low energy implications of the attempts at constructing a quantum theory of gravity unified with particle interactions. In particular superstring theories offer a grandiose program for a complete description of all particle interactions. In these lectures, we review current ideas on physics beyond the standard model in the light of these new developments.

25336 (IN2P3—87-01-Vol.1, pp 45-120) Aspects of supergravity models. Savoy, C.A. (Centre de Recherches Nucleaires, 67 - Strasbourg, France). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752226/JAW. (CONF-8509292—).

From 17. summer school of particle physics; Clermont-Ferrand, France (9 Sep 1985).

Lecture 1 is a detailed discussion of the massless multiplets of the supersymmetry algebra, to show the particle content of various supersymmetric theories. In Lecture 2, the field content and the lagrangians of N = 1 theories are discussed and the spontaneous breaking of global supersymmetry is considered. Lecture 3 is a general description of N = 1 supergravity models and the breaking of local supersymmetry. Finally, the low energy limit of minimal supergravity models, including strong and electroweak interactions, is presented in Lecture 4.

25337 (IN2P3—87-01-Vol.1, pp 121-216) Standard model beyond the TeV. Aurenche, P. (Grenoble Univ., 74 - Annecy-le-Vieux, France. Lab. de Physique des Particules). 1987. (In French). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752226/JAW. (CONF-8509292—).

From 17. summer school of particle physics; Clermont-Ferrand, France (9 Sep 1985).

The phenomenology of the standard model in the hadronic reactions in the 10 TeV range is described. The predictions of the model concerning the hadronic cross sections being based on the

parton model, we first discuss the behaviour of the structure functions at the low values of X (x > 10/sup -4/) which are attained at these energies and we show that the development of the leading logarithms equations allow us to calculate them. The production of W, Z, and gauge bosons and gauge boson pairs are reviewed. The Higgs boson production is discussed in detail according to his mass value.

25338 (IN2P3—87-01-Vol.1, pp 217-258) **Are quarks and leptons composite or elementary.** Peccei, R.D. (Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany, F.R.). 1987. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752226/JAW. (CONF-8509292—).

From 17. summer school of particle physics; Clermont-Ferrand, France (9 Sep 1985).

In these lectures I discuss the issue of the origin of the quark and lepton masses, both in the case in which these objects are elementary and in the case they are composite. Some of the generic predictions and dynamical assumptions of GUTS, family symmetry models and superstrings are detailed. They are contrasted to the dynamics required for composite models of quarks and leptons. In this latter case, the difficulties of protecting dynamically fermion masses and yet still generating intra and interfamily hierarchies is emphasized.

25339 (IN2P3—87-01-Vol.1, pp 259-283) **Phenomenology of a substructure of leptons, quarks and W/sup +/, W/sup -/ Z/sup 0/ bosons.** Renard, F.M. (Montpellier Univ., 30 -, France). 1987. (In French). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752226/JAW. (CONF-8509292—).

From 17. summer school of particle physics; Clermont-Ferrand, France (9 Sep 1985).

We present the spectroscopy of new particles and new interactions assuming the case of leptons, quarks and W and Z bosons as formed of substructures. The experimental limits of the scale of the substructure and the couplings and the masses of these new particles are given. The possibilities of the futur e/sup +/e/sup -/, ep, pp and pantip colliders are reviewed.

25340 (IN2P3—87-01-Vol.1, pp 284-317) **Introduction to some aspects of composite models.** Perrottet, M. (CNRS, 13 - Marseille-Luminy, France. Centre de Physique Theorique). 1987. (In French). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752226/JAW. (CONF-8509292—).

From 17. summer school of particle physics; Clermont-Ferrand, France (9 Sep 1985).

A possibility to solve some deficiencies of the standard model is that the quarks and the leptons are composite systems. The difficulties of this program are qualitatively described to explain the spectrum of the elementary fermions. The comparison of the effective lagrangians with experiment allows to define a scale of mass associated with the subconstituents dynamics. If the massive gauge bosons of the weak interaction are composite it is possible to consider the weak interactions as residual interaction of a new force (hypercolor) responsible of the confinement of the subconstituents. It is possible in this case to obtain the phenomenology of the weak interactions at low energy and the masses of the intermediate bosons. Some combinatory aspects of the composite models are examined.

25341 (INIS-mf—10567, pp 147-155) **β decay of the free neutron in confining constituent models.** Tegen, R. (Institute of Theoretical Physics and Astrophysics, University of Cape Town, South Africa). 1986. NTIS (US Sales Only), PC A12/MF A01. Order Number DE87701986/JAW. (CONF-8607120—; CONF-8507150—).

From 21. annual seminar on theoretical physics; Johannesburg, South Africa (8 Jul 1986).

The papers on the 20th and 21st annual seminars on theoretical physics are bound in one volume.

The axial-vector weak coupling constant g/sub A/ in constituent models is discussed and shows that (g/sub A//g/sub V/) receives contributions only from fields contributing to the helicity of the nucleon. This helicity argument is useful for the modelling of the hadrons in terms of (hybrid) Skyrmions. The smallness of center-of-mass/recoil corrections to (g/sub A//g/sub V/) as well as the strong surface dependence of (g/sub A//g/sub V/) are explained from this point of view. For chiral soliton models the helicity argument implies that there are no mesonic contributions to g/sub A/. This constrains possible shapes for confining potentials. In particular strong deviations are found from the chiral circle in the surface region. As a result the pion field is appreciably suppressed inside the confinement region.

25342 (INIS-mf—11041, pp 9-16) **Weak neutral current effects in the extended Weinberg-Salam models.** Lendvai, E. (Roland Eoetvoes Univ., Budapest (Hungary). Inst. for Theoretical Physics). 1983. NTIS (US Sales Only), PC A99/MF A01. Order Number DE88700434/JAW. (CONF-8306119—).

From 3. symposium on medical application of cyclotrons; Turku, Finland (12 Jun 1983).

The minimal extensions of Weinberg-Salam models in which the low energy behaviour is the same as in standard model are considered. (M.F.W.).

25343 (ISN—87-56) **On the H particle stability in the non relativistic quark model.** Silvestre-Brac, B.; Carbonell, J.; Gignoux, C. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). May 1987. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752165/JAW.

The H particle with quark content (uuddss) is presented as a good candidate to be stable with respect to strong interactions. In the framework of a non relativistic potential model, the binding energy is calculated by a full dynamical approach using a resonating group trial wave function. The center of mass motion and the Pauli principle are correctly treated. Sophisticated baryon wave functions are employed and the equation of motion is solved with six coupled channels including radial excited baryon states. The effect of breaking SU(3) flavour symmetry is discussed in detail.

25344 (ITEP—28(1987)) **Predictions for the boson masses and widths in the quark-gluon string model. Systems of heavy and light quarks.** Kaidalov, A.B.; Nogteva, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701943/JAW.

The masses and widths of the systems consisting of light (u, d, s) and heavy (c, b) quarks in the quark-gluon string model are presented. The predicted masses for boson resonances (D^*, D^{**}, F^*, B^* ...) are in good agreement with experimental data. Hadronic widths of heavy boson resonances are estimated. It is pointed out that in many cases these resonances should be very narrow. 15 refs.

25345 (ITEP—68(1987)) **Vacuum background fields in QCD as a source of confinement.** Simonov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701944/JAW.

Large distance behaviour of quark and gluon Green functions is studied in vacuum background fields. Periodic and bounded stochastic fields do not ensure confinement. New stochastic vacuum configurations are suggested, which generate a superlocalization regime, i.e. a large distance decay of Green functions faster than the exponential one. This latter regime corresponds to the confinement. 34 refs.

25346 (NBI-HE—87-48) **Weak marionettes.** Kosower, D.A. (Niels Bohr Inst., Copenhagen (Denmark); Columbia Univ., New York (USA). Dept. of Physics). Jul 1987. 5p. (CUTP—87/377). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751037/JAW.

A variant of the strongly-coupled standard model of Claudson, Farhi, and Jaffe may lead to the existence of a light spin-2 particle, with mass comparable to that of the W boson.

25347 (NBI-HE—87-67) On the directional dependence of Bose-Einstein correlations. Kvatadze, R.A.; Moeller, R.; Loerstad, B. (Niels Bohr Inst., Copenhagen (Denmark); Lund Univ. (Sweden)). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Lund Univ. (Sweden)). Nov 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752702/JAW.

A simple method to measure the shape of the particle emission region in high energy particle collisions by interferometry is discussed. Results from an application to data on inelastic pp scattering are compared with results based on determinations of the radial extensions of the source. Both show that in the c.m.s., the source is elongated in the beam direction.

25348 (NBI-HE—87-81) Strange matter at finite temperatures. Reinhardt, H.; Dang, B.V. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). (Niels Bohr Inst., Copenhagen (Denmark); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Dec 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752704/JAW.

The properties of strange quark matter at finite temperatures and in equilibrium with respect to weak interaction are explored on the basis of the MIT bag model picture of QCD. Furthermore, to determine the stability of strange quark matter analogous investigations are also performed for nuclear matter within Walecka's model field theory. It is found that strange quark matter can be stable at zero external pressure only for temperatures below 20 MeV.

25349 (RAL—88-007) Spin content of the proton. Close, F.E.; Roberts, R.G. (Tennessee Univ., Knoxville (USA). Dept. of Physics). (Rutherford Appleton Lab., Chilton (UK)). Jan 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88752797/JAW.

Data on polarised lepton-proton scattering are shown to give no clear conclusion on the spin content of the proton. We argue that errors have been underestimated, specifically those arising from the uncertainty of the extrapolation to infinite energy (x -> O). Estimates of the spin content are sensitive to such uncertainty and possible ways of surmounting this problem are discussed.

25350 (SLAC-PUB—4521) B^0-anti B^0 mixing: A theoretical evaluation after ARGUS. Bigi, I. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jan 1988. Contract AC03-76SF00515. 12p. (CONF-870821—9). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005877/JAW.

From SLAC summer institute on particle physics; Stanford, CA, USA (10 Aug 1987).

After an introduction into the phenomenology of B^0 -anti B^0 mixing is given, a rather detailed is presented on the theoretical concepts that are involved. An attempt is made to elucidate the discrepancy between different theoretical claims. CP violtion is touched only very briefly.

25351 (USIP—87-03) Charm hadro-production, the Lund model and the LEBC-EHS experiment. Haupt, L. (Stockholm Univ. (Sweden). Inst. of Physics). Mar 1987. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751043/JAW.

A charm particle production model is compared with data from 360 GeV/c π/sup -/p interactions. The charm quark production is described by the two processes gluon fusion and quark-antiquark annihilation in perturbative QCD, and complete hadronic events are obtained using the Lund fragmentation model. The data were collected with the high resolution rapid cycling bubble chamber LEBC and the European Hybrid Spectrometer, EHS, and correspond to a sensitivity of 15.8 events/μb. The inclusive D-meson cross section at x/sub F/ > 0 is measured to be 15.8 +- 2.7 μb. The corresponding cross section in the model, calculated using α/sub s/ = 0.3 and m/sub c/ = 1.25 GeV/c/sup 2/, is estimated to be a factor 2-3 lower. The gluon and quark fusion processes contribute 85 and 15%, respectively. The x/sub F/ distribution of D-mesons in the forward hemisphere is described by a leading and a non-leading component which are well described by the model. The p/sup 2//sub T/ distribution fits data well for an intrinsic transverse momentum of the parton system of <k/sup 2//sub T/> = 0.82 (GeV/c)/sup 2/. The fragmentation plays an important role for the hadron distributions, and these are well represented by the Lund model. The average charged multiplicity in charm events is measured to be 10.4 +- 0.6, which is larger than the multiplicity measured in soft hadron interactions at the same energy.

25352 On the stability of the Skyrme-model soliton with unit Hopf charge. Hlousek, Z.; Shertzer, J. (Department of Physics, Brown University, Providence, Rhode Island 02912). *Physical Review [Section] D: Particles and Fields;* **37**: No. 5, 1279-1284(1 Mar 1988).

We show that the Hopf soliton (Q/sub H/ = 1) in the Skyrme model is an unstable configuration. The small fluctuations around the classical solution satisfy the Schroedinger-type equation. As usual this can be interpreted in terms of the particle analogue. We find that the particle analogue has bound states. The energy of the particle analogue is equal to the square of the oscillation frequency around the Hopf soliton background. For bound states the energy is negative which means that the oscillation frequency is imaginary. Therefore the quantum correction to the Hopf soliton grows exponentially in time. This makes the Hopf soliton of the Skyrme model an unstable configuration.

25353 Mixing of the photon with low-mass particles. Raffelt, G.; Stodolsky, L. (Astronomy Department, University of California, Berkeley, California 94720). *Physical Review [Section] D: Particles and Fields;* **37**: No. 5, 1237-1249(1 Mar 1988).

Photons can mix with low-mass bosons in the presence of external electromagnetic fields if these particles: not necessarily of spin 1: couple by a two-photon vertex. Important examples are the hypothetical axion (spin 0) and graviton (spin 2). We develop a formalism which is adapted to study the evolution of a photon (axion, graviton) beam in the presence of external fields. We apply our results to discuss the possibility of detecting axions by a measurement of the magnetically induced birefringence of the vacuum. We also discuss photon-axion (graviton) transitions in pulsar magnetic fields. The QED-induced nonlinearity of Maxwell's equations causes magnetic birefringence effects which are much stronger than the axion-induced effects in the range of axion parameters allowed by astrophysical constraints. Also, this QED effect induces an index of refraction for photons in vacuum which is so large near pulsars that photon-axion (graviton) transitions are strongly suppressed. However, this QED effect can be canceled by plasma refractive effects, leading to degeneracy between photons and axions so that resonant transitions can occur in analogy with the Mikheyev-Smirnov-Wolfenstein effect. The adiabatic condition can be met only in spatially extended systems, possibly in the magnetosphere of magnetic white dwarfs. Our conclusions differ substantially from several recent discussions of various aspects of these mixing phenomena.

25354 Heavy leptons at hadron supercolliders. Barger, V.; Han, T.; Ohnemus, J. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review [Section] D: Particles and Fields;* **37**: No. 5, 1174-1187(1 Mar 1988).

The production, decay, and detection of a fourth-generation charged heavy lepton L at multi-TeV hadron supercolliders is discussed for masses m/sub L/>M/sub W/ and m/sub ν//sub >// sub L/$\cong$0. The leptonic and hadronic decay signals for single L production and LL-bar pair production are evaluated. In all channels examined the heavy-lepton signal is smaller than backgrounds from single and pair production of W/sup +- / and Z bosons. However, it may still be possible to detect a heavy lepton from its contribution to pX/sub T/+2 or 4 jets events where the Z($\rightarrow\nu\nu$-bar)+jets background may be determined from measurements of (Z$\rightarrow$ll-bar)+jets events.

25355 Mixing effects on Z-boson properties in E_6 theories. Rizzo, T.G. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] D: Particles and Fields;* **37**: No. 5, 1232-1236(1 Mar 1988). Contract W-7405-ENG-82.

The existence of a new neutral gauge boson (Z') in superstring-inspired E_8 models may lead to modifications of the properties of the usual Z boson of the standard model via Z-Z' mixing. The width and partial decay modes of Z as well as asymmetries at e^+e^- and p-barp colliders are shown to be reasonably sensitive to such mixing. A wide range of E_8 models is examined.

25356 **Axigluon production in hadronic collisions.** Bagger, J.; Schmidt, C.; King, S. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). *Physical Review* [*Section*] *D: Particles and Fields;* **37**: No. 5, 1188-1196(1 Mar 1988).

Recently proposed chiral-color models predict the existence of a massive color octet of vector bosons, the axigluon. In this paper we investigate axigluon production in hadronic collisions. We compute the single-jet inclusive cross section and the two-jet invariant-mass distribution for the CERN collider, the Fermilab Tevatron, and the Superconducting Super Collider. We use CERN data to exclude axigluon masses between 125 and 275 GeV, subject to a mild constraint on the width.

25357 **Hadronic transitions and $^1P_1$ states of heavy quarkonia.** Kuang, Y.; Tuan, S.F.; Yan, T. (Center of Theoretical Physics, Chinese Center of Advanced Science Technology (World Laboratory), Beijing, People's Republic of China China People's Republic of China). *Physical Review* [*Section*] *D: Particles and Fields;* **37**: No. 5, 1210-1219(1 Mar 1988).

Stimulated by both new experimental data and theoretical interest, the properties of the spin-singlet P state ($^1P_1$) in the cc-bar and bb-bar system have been reexamined in the framework of the QCD multipole expansion. We have estimated various rates for producing psi(1 $^1P_1$) and Y(1 $^1P_1$) in hadronic transitions, and for producing psi(1 $^1P_1$) in pp-bar annihilation. The $\pi\pi$ mass spectrum in the transition $Y''\rightarrow Y(1\ ^1P_1)\pi\pi$ has been computed, and the two pions peak at low masses. An interesting approximation proposed by Voloshin and Zakharov is explored further in conjunction with the axial anomaly to relate many isospin-violating π^0 transitions involving $^1P_1$ to the known rate of psi'→J/psi π^0. The rates for psi'→psi(1 $^1P_1$)π^0 and psi(1 $^1P_1$)→J/psi π^0 are found to be large. The implications are discussed.

25358 **Higgs decay to tau/sup +/tau/sup -/. A possible signature of intermediate mass Higgs bosons at high energy hadron colliders.** Ellis, R.K.; Soldate, M.; Van der Bij, J.J.; Hinchliffe, I. (Fermi National Accelerator Lab., Batavia, IL (USA); Lawrence Berkeley Lab., CA (USA)). *Nuclear Physics* [*Section*] *B;* **297**: No. 2, 221-243(8 Feb 1988). Contract AC03-76SF00098.

This paper considers the decay of a standard model Higgs boson into a tau pair, as a possible signature at the SSC or LHC for a Higgs boson of mass between 110 and 160 GeV. The production of the Higgs in association with a large transverse momentum jet is considered, since this may aid in reconstructing the Higgs mass. The background from the production of tau pairs via virtual photons and Z's is studied. We comment on the possible use of this process to search for a light Higgs at the Tevatron collider.

25359 **Effective action for the standard model with large Higgs mass.** Cheyette, O. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Physics). *Nuclear Physics* [*Section*] *B;* **297**: No. 1, 183-204(1 Feb 1988). Contract AC03-76SF00098.

The covariant derivative expansion of the one-loop effective action is briefly reviewed, and applied to the problem of calculating the heavy Higgs effects in the standard Glashow-Weinberg-Salam model. All terms which grow with the Higgs mass M/sub H/ at one loop are found. The result of this calculation is used to find the dependence of the gauge boson mass ratio rho on M/sub H/, and also to estimate the size of corrections to W and Z scattering theorems.

25360 **Testing the Fritzsch quark mass matrices with the invariant function approach.** Albright, C.H.; Jarlskog, C.; Lindholm, B.A. (Fermi National Accelerator Lab., Batavia, IL (USA); Northern Illinois Univ., De Kalb (USA). Dept. of Physics; Stockholm Univ. (Sweden). Dept. of Physics). *Physics Letters* [*Section*] *B;* **199**: No. 4, 553-559(31 Dec 1987).

The invariant function approach using projection operator techniques is applied to the Fritzsch mass matrices to calculate exactly the absolute squares of the Kobayashi-Maskawa matrix elements and the invariant J-value associated with CP violation. The overlap of the experimentally allowed annular KM region and the B/sub d//sup 0/-anti B/sub d//sup 0/ band in the phi/sub B/ versus m/sub t/ plane is small but consistent with a light strange quark and heavy top quark with mass, m/sub t//sup phys/ ≃ 100 GeV. Mixing in the B/sub s//sup 0/-anti B/sub s//sup 0/ channel is predicted to be nearly complete, and the amplitude for the (b->u)/(b->c) transition is calculated to be about 0.06.

25361 **High-mass meson spectroscopy and the diquark-antiquark model for the U particle.** Lipkin, H.J. (Argonne National Lab., IL (USA); Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). *Physics Letters* [*Section*] *B;* **199**: No. 4, 567-574(31 Dec 1987). Contract W-31-109-ENG-38.

The recently discovered high-mass K/sup */ resonances and exotic (Y = +- 1; I = 3/2) U mesons give new information on hadron decay dynamics and multiquark interactions. Masses for the U in reasonable agreement with experiment are estimated from known hadron masses by a nearly model-independent approach using an orbitally excited diquark-antidiquark model with wave functions scaled from wave functions of known mesons and effective matrix elements of kinetic and potential energies obtained without a detailed model from experimental hadron masses. Relative branching ratios into different decay modes are discussed with new implications of high-mass K/sup */ branching ratios for hadron dynamics and charmed D-meson decays. The U -> anti p$\pi\Lambda$ decay is predicted to be dominated by anti $\Delta\Lambda$ with no anti pΣ/sup */.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 25331, 25355

25362 **(IC—86/259) Anomalies of BRS and anti-BRS Ward-identities in N=1 supersymmetric theory.** Lhallabi, T. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1986. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701826/JAW.

The requirement of BRS and anti-BRS symmetries in the N=1 supersymmetric theory leads to Ward-Identities independent of the gauge parameter. The cohomology conditions are immediately satisfied. The determination of a supersymmetric compact formula for the anomaly is not affected by the anti-BRS symmetry. (author). 30 refs.

25363 **(IC—86/389) Role of symmetry principles in high energy physics.** Pal, B.K. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701850/JAW.

Quantum Mechanics and its extension Quantum Field Theory with the help of symmetry principles as keys have played an important role in studying the nature of fundamental constituents of matter and their intractions. A brief history of these areas of physics is the primary aim of this review article. (author). 19 refs.

25364 **(IC—87/118) Non-local representations of the current group SU(1.1)/sup X/ and invariant vertex operators in dual-resonance models.** Verdiyev, Yi.A. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701861/JAW.

A new three-Reggeon vertex operator is proposed and constructed from irreducible non-local representation of the infinite dimensional current group SU(1.1)/sup X/ and is related to the three-

linear invariant form. The Wigner coefficients of the group SU(1.1) play the essential role in this construction. (author). 10 refs.

25365 **(RRK—87-20) Path integral, BRS symmetry, and string and membrane theories.** Fujikawa, Kazuo. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Sep 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752300/JAW.

A unified treatment of quantum symmetries is attempted on the basis of the BRS symmetry appearing in the path integral. We first briefly review a systematic derivation of anomalous commutators and the fact that all the known non-trivial anomalous commutators are related to the anomaly. We next present a refined treatment of the reparametrization invariant path integral measure, which is then illustrated for the two-dimensional string theory. The critical dimension is shown to arise from the explicit or implicit gauge fixing of the Weyl freedom. We finally present a Faddeev-Popov-BRS treatment of the bosonic membrane. The narrow limit of the quantized closed membrane is shown to reproduce certain massless states of the closed string.

25366 **(RRK—87-21) Super Virasoro algebra and solvable supersymmetric quantum field theories.** Yamanaka, Itaru; Sasaki, Ryu. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Sep 1987. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752299/JAW.

Interesting and deep relationships between super Virasoro algebras and super soliton systems (super KdV, super mKdV and super sine-Gordon equations) are investigated at both classical and quantum levels. An infinite set of conserved quantities responsible for solvability is characterized by super Virasoro algebras only. Several members of the infinite set of conserved quantities are derived explicitly.

25367 **(RRK—87-23) Relation between anomaly in type-I superstring and anomaly in its effective theory.** Nagahama, Yoshinori. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Oct 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752332/JAW.

We explicitly calculate the hexagon and heptagon (covariant) gauge anomaly including the precise numerical coefficients in type-I open superstring. The calculation is performed by using the Pauli-Villars regularization on the basis of the stringy Ward identity, which is an assumption weaker than the cancelled propagator argument. We show that the anomalies in the effective theory are realized as the zero slope limit ($\alpha' \to 0$) of the string anomalies in a very non-trivial way in the present calculational scheme. This non-trivial realization in higher point ($n \geq 8$) anomalies is also discussed.

25368 **Bag formation in the presence of vector mesons. II. Inclusion of scalars.** Meissner, U.; Johnson, R.; Park, N.W.; Schechter, J. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139). *Physical Review [Section] D: Particles and Fields;* **37**: No. 5, 1285-1288(1 Mar 1988).

We construct an effective Lagrangian of pions, the vector mesons rho and ω, as well as a scalar meson and a scalar glueball which incorporates chiral symmetry and the QCD trace anomaly. The scalar sector is set up so that it contains particles in a realistic mass range with physically narrow widths. We calculate static nucleon properties and demonstrate that shallow bags with typical confinement sizes of $R \sim 1/2$ fm are favored by phenomenology.

6454 Field Theory

REFER ALSO TO CITATION(S) 25268, 25352, 25353, 25355, 25357, 25368, 25498

25369 **(AECL—8261) New method for the regularization of a class of divergent Feynman integrals in covariant and axial gauges.** Lee, H.C.; Milgram, M.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1984. 90p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701782/JAW.

A hybrid of dimensional and analytic regularization is used to regulate and uncover a Meijer's G-function representation for a class of massless, divergent Feynman integrals in an axial gauge. Integrals in the covariant gauge belong to a subclass and those in the light-cone gauge are reached by analytic continuation. The method decouples the physical ultraviolet and infrared singularities from the spurious axial gauge singularity but regulates all three simultaneously. For the axial gauge singularity, the new analytic method is more powerful and elegant than the old principal value prescription, but the two methods yield identical infinite as well as regular parts. It is shown that dimensional and analytic regularization can be made equivalent, implying that the former method is free from spurious $\gamma 5$-anomalies and the latter preserves gauge invariance. The hybrid method permits the evaluation of integrals containing arbritrary integer powers of logarithms in the integrand by differentiation with respect to exponents. Such 'exponent derivatives' generate the same set of 'polylogs' as that generated in multi-loop integrals in perturbation theories and may be useful for solving equations in nonperturbation theories. The close relation between the method of exponent derivatives and the prescription of 't Hooft and Veltman for treating overlapping divergencies is pointed out. It is demonstrated that both methods generate functions that are free from unrecognizable logarithmic infinite parts. Nonperturbation theories expressed in terms of exponent derivatives are thus renormalizable. Some intriguing connections between nonperturbation theories and nonintegral exponents are pointed out.

25370 **(AECL—8630) Yang-Mills theories in axial and light-cone gauges, analytic regularization and Ward identities.** Lee, H.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Dec 1984. 93p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701784/JAW.

Lectures given at the Physics Centre, National Taiwan University, Taipei, 1984 March and April.

The application of the principles of generalization and analytic continuation to the regularization of divergent Feynman integrals is discussed. The technique, or analytic regularization, which is a generalization of dimensional regularization, is used to derive analytic representations for two classes of massless two-point integrals. The first class is based on the principal-value prescription and includes integrals encountered in quantum field theories in the ghost-free axial gauge (n.A=0), reducing in a special case to integrals in the light-cone gauge (n.A=0,n/sup 2/=0). The second class is based on the Mandelstam prescription devised espcially for the light-cone gauge. For some light-cone gauge integrals the two representations are not equivalent. Both classes include as a subclass integrals in the Lorentz covariant 'zeta-gauges'. The representations are used to compute one-loop corrections to the self-energy and the three-vertex in Yang-Mills theories in the axial and light-cone gauges, showing that the two- and three-point Ward identities are satisfied; to illustrate that ultraviolet and infrared singularities, indistinguishable in dimensional regularization, can be separated analytically; and to show that certain tadpole integrals vanish because of an exact cancellation between ultraviolet and infrared singularities. In the axial gauge, the wavefunction and vertex renormalization constants, Z/sub 3/ and Z/sub 1/, are identical, so that the β-function can be directly derived from Z/sub 3/ the result being the same as that computed in the covariant zeta-gauges. Preliminary results suggest that the light-cone gauge in the Mandelstam prescription, but not in the principal value prescription, has the same renormalization property of the axial gauge.

25371 (IC—87/119) Massive Yang-Mills theory: Renormalizability versus unitarity. Delbourgo, R.; Twisk, S.; Thompson, G. (Tasmania Univ., Sandy Bay (Australia). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701862/JAW.

Various massive Yang-Mills theories not based on the Higgs mechanism are investigated. They are subject to conflicting demands in the twin requirements of unitarity and perturbative renormalizability. Either one or other of these requirements is violated. Unitarity is considered in some detail. (author). 18 refs, 5 figs.

25372 (IC—87/120) Radiationless Zitterbewegung of Dirac particles and mass formula. Noboru Hokkyo. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701863/JAW.

The Zitterbewegung of the Dirac particle is given a visual representation by solving the two-component difference form of the Dirac equation. It is seen that the space-time trajectory of a Dirac particle can be pictured as a correlated whole of a network of zigzags of left- and right-handed chiral neutrino-like line elements. These zigzags can feel the curl of the external electromagnetic vector potential and give rise to the spin magnetic interaction, confirming Schroedinger's earlier intuitive picture of the spin as the orbital angular momentum of the Zitterbewegung. The network of zigzags associated with an electron splits and reunites in passing through the slits in the electron beam interference experiment. It is proposed to interpret Nambu's empirical mass formula m/sub n/ =(n/2)137m/sub e/=(n/2)((h/2π)/cL), n=integer, as a radiationless condition for the Zitterbewegung of the hadronic Dirac particle of the linear spatial extension of the order of the classical electron radius L=e/sup 2//m/sub e/c/sup 2/. (author). 20 refs, 4 figs.

25373 (IC—87/155) On the associativity anomaly in open string field theory. Rakowski, M.; Thompson, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701897/JAW.

The associativity anomaly in the star algebra of the open bosonic string is demonstrated by a simple oscillator calculation. In an associative algebra, formal arguments require that the "half string" BRST operator Q/sub L/ be nilpotent; however, we show that associativity is actually violated by computing Q/sub L//sup 2/ in an explicit operator representation of the star algebra. (author). 8 refs.

25374 (IC—87/160) Temperature and the critical dimension of strings. Ahmed, E. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701902/JAW.

Using thermofield dynamics (T.F.D) one generalizes the BRST invariance of strings to non-zero temperature. The requirement that the BRST generator is nilpotent implies that d=26 even at finite temperature. (author). 7 refs.

25375 (NBI-HE—87-46) Contact interactions of closed superstrings. Greensite, J. (Niels Bohr Inst., Copenhagen (Denmark); San Francisco State Univ., CA (USA). Dept. of Physics and Astronomy). Jul 1987. 10p. (CONF-8703143—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751036/JAW.

From Workshop on superstrings, composite structures, and cosmology; College Park, MD, USA (11 Mar 1987).

It is shown that closed light-cone superstring field theory, which is presently formulated with only cubic interaction terms, does not have a stable ground state, and that the global supersymmetry algebra is violated at second order in the coupling. Local contact interactions, of quartic (and possibly higher) order in the string fields, must be added to the light-cone Hamiltonian to restore supersymmetry and vacuum stability.

25376 (NBI-HE—87-47) Regularized strings with extrinsic curvature. Ambjoern, J.; Durhuus, B.; Froehlich, J.; Jonsson, T. (Niels Bohr Inst., Copenhagen (Denmark); Copenhagen Univ. (Denmark). Matematisk Inst.; Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Theoretische Physik; Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Theoretische Physik; Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Jul 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752694/JAW.

We analyze models of discretized string theories, where the path integral over world sheet variables is regularized by summing over triangulated surfaces. The inclusion of curvature in the action is a necessity for the scaling of the string tension. We discuss the physical properties of models with extrinsic curvature terms in the action and show that the string tension vanishes at the critical point where the bare extrinsic curvature coupling tends to infinity. Similar results are derived for models with intrinsic curvature.

25377 (NBI-HE—87-53) Random surfaces and strings. Ambjoern, J. (Niels Bohr Inst., Copenhagen (Denmark)). Aug 1987. 7p. (CONF-8706279—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751040/JAW.

From ESP meeting; Uppsala, Sweden (25 Jun 1987).

The theory of strings is the theory of random surfaces. I review the present attempts to regularize the world sheet of the string by triangulation. The corresponding statistical theory of triangulated random surfaces has a surprising rich structure, but the connection to conventional string theory seems non-trivial.

25378 (NBI-HE—87-56) Non-abelian bosonization in higher genus Riemann surfaces. Koh, I.G.; Yu, M. (Niels Bohr Inst., Copenhagen (Denmark)). Aug 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752696/JAW.

We propose a generalization of the character formulas of the SU(2) Kac-Moody algebra to higher genus Riemann surfaces. With this construction, we show that the modular invariant partition function of the SO(4) $\kappa = 1$ Wess-Zumino model is equivalent, in arbitrary genus Riemann surfaces, to that of free fermion theory.

25379 (NBI-HE—87-58) Superstring amplitudes and contact interactions. Greensite, J.; Klinkhamer, F.R. (San Francisco State Univ., CA (USA). Dept. of Physics and Astronomy; Lawrence Berkeley Lab., CA (USA)). (Niels Bohr Inst., Copenhagen (Denmark); San Francisco State Univ., CA (USA). Dept. of Physics and Astronomy; Lawrence Berkeley Lab., CA (USA)). Aug 1987. 21p. (LBL—23830). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752697/JAW.

We show that scattering amplitudes computed from light-cone superstring field theory are divergent at tree level. The divergences can be eliminated, and supersymmetry restored, by the addition of certain counter terms to the light-cone Hamiltonian. These counter terms have the form of local contact interactions, whose existence we had previously deduced on grounds of vacuum stability, and closure of the super-Poincare algebra. The quartic contact interactions required in Type I and Type IIB superstring theories are constructed in detail.

25380 (NBI-HE—87-62) On the energy-momentum tensor in non-linear σ-models with torsion. Dorn, H.; Otto, H.J. (Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik). (Niels Bohr Inst., Copenhagen (Denmark); Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik). Oct 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752700/JAW.

We study the renormalization properties of the energy-momentum tensor in a σ-model with torsion. Our normal product version contains besides the classical expression and the trace anomaly an off diagonal term proportional to the squared torsion. Special-

ized to a group manifold this term is crucial to reproduce the correct perturbative expansion of the energy-momentum tensor in Sugawara form.

25381 **(NBI-HE—87-65) 't Hooft-Polyakov monopoles and Dirac strings in the 3D Georgi-Glashow model: A lattice investigation.** Laursen, M.L.; Mueller-Preussker, M. (Niels Bohr Inst., Copenhagen (Denmark); Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik). Nov 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752701/JAW.

After having roughly scanned the phase structure of the 3D Georgi-Glashow model on an 8/sup 3/ lattice, with periodic boundary conditions, we investigate it's quantized vacuum with respect to monopole-antimonopole manti m excitations near the Higgs phase transition (PT). Starting from Monte Carlo generated equilibrium configurations, a Langevin type relaxation procedure is applied in order to freeze out the quantum fluctuations. As expected, from continuum considerations, we find quasi stable plateaus in the action corresponding to manti m pairs of the non-Abelian 't Hooft-Polyakov type. Our data show that the density of these pairs drops very sharply at the PT, thus supporting the dilute gas picture. In addition we observe stable Abelian Dirac strings, which arise from manti m pairs annihilating through the boundaries.

25382 **(NBI-HE—87-68) Diagrammatic methods in phase-space regularization.** Bern, Z.; Halpern, M.B. (Niels Bohr Inst., Copenhagen (Denmark); Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Physics). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Physics). Nov 1987. 29p. (LBL—24234). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752703/JAW.

Using the scalar prototype and gauge theory as the simplest possible examples, diagrammatic methods are developed for the recently proposed phase-space form of continuum regularization. A number of one-loop and all-order applications are given, including general diagrammatic discussions of the nogrowth theorem and the uniqueness of the phase-space stochastic calculus. The approach also generates an alternate derivation of the equivalence of the large-β phase-space regularization to the more conventional coordinate-space regularization.

25383 **(NORDITA—87/50-P(prepr.)) Simple expression for the multiloop amplitude in the bosonic string.** Di Vecchia, P.; Frau, M.; Lerda, A.; Sciuto, S. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy); State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics; Naples Univ. (Italy). Dipt. di Fisica; Istituto Nazionale di Fisica Nucleare, Turin (Italy)). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy); State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics; Istituto Nazionale di Fisica Nucleare, Turin (Italy)). 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752710/JAW.

Using the previously constructed new N String Vertex and BRST invariant twisted propagator we obtain a simple and explicit expression for the multiloop partition function of the bosonic string. We construct also the two loop amplitude with N external tachyons and give the recipe for writing the amplitude at any perturbative order.

25384 **First-order chiral phase transition with a realistic current-quark spectrum.** Gavai; Potvin, J.; Sanielevici, S. (Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay 400005, India). *Physical Review* [*Section*] *D: Particles and Fields;* **37**: No. 5, 1343-1346(1 Mar 1988).

By means of a Langevin algorithm which incorporates the dynamical effects of various fermion species of nondegenerate masses, we simulate QCD with an isodoublet of quarks of mass 0.025 in lattice units and a heavier strange quark on an $8^3 \times 4$ lattice. Our results suggest that the finite-temperature QCD phase transition in the real world is first order, that it is driven by the light condensate, and that it might be accompanied by a partial restoration of U(1)/sub A/ symmetry.

25385 **New phase of quantum electrodynamics: A nonperturbative fixed point in four dimensions.** Kogut, J.B.; Dagotto, E.; Kocic, A. (Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801). *Physical Review Letters;* **60**: No. 9, 772-775(29 Feb 1988).

Finite-size studies of noncompact quantum electrodynamics with four species of almost massless fermions suggest that there is an ultraviolet-stable, nonperturbative fixed point in four dimensions which describes an interacting field theory of bound states. This theory may be relevant to grand unification schemes, technicolor, and recent anomalous heavy-ion experiments.

25386 **Superstrings on hyperelliptic surfaces and the two-loop vanishing of the cosmological constant.** Montano, D. (Stanford Linear Accelerator Center, CA (USA)). *Nuclear Physics* [*Section*] *B;* **297**: No. 1, 125-140(1 Feb 1988). Contract AC03-76SF00515.

We calculate the supersymmetric type II string partition function in a flat background for the situation where the world-sheet is hyperelliptic. We show explicitly that the contribution to the cosmological constant from hyperelliptic world-surfaces vanishes for genus ≤ 20. This implies, in particular, that the cosmological constant vanishes completely to two loops. Due to the decoupling of the holomorphic and antiholomorphic sectors, this conclusion holds equally well for the heterotic string.

25387 **Study of the chiral transition in a U(1) gauge-Higgs-fermion theory with Yukawa couplings.** Lee, I.H.; Shrock, R.E. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.; State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics). *Physics Letters* [*Section*] *B;* **199**: No. 4, 541-546(31 Dec 1987). Contract AC02-76CH00016.

We study the (zero-temperature) chiral transition in a U(1) gauge-Higgs-fermion theory with Yukawa couplings involving fermions of two different charges. Using analytic methods in the strong coupling limit, we find that for a range of sufficiently weak Yukawa couplings, this transition continues to exist and be of second-order, but is removed as the strength of the Yukawa coupling increases through a critical value. Some implications for the continuum limit of this model, and for electroweak interactions, are noted.

65 PHYSICS II

REFER ALSO TO CITATION(S) 25262, 25263, 25265

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 25450

25388 **(CEA-CONF—9199) Nuclear reactions with real photons.** Carlos, P.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Basse Energie). Jun 1987. 24p. (CONF-8706251—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752223/JAW.

From Workshop on intermediate energies; Grenoble, France (3 Jun 1987).

I will discuss briefly the following experimental points: 1- The nuclear response function for the photon energies $\nu < 140$ MeV, where it is shown that two-body currents, arising mainly from meson exchange effects (MEC) are of relevant importance. 2- The nucleon and nuclear response functions for 140 MeV $< \nu <$

2-3 GeV. The photon-nucleus interaction in the Δ resonance will be discussed in terms of pion photoproduction and two (three ?)-body interactions. 3- Finally for $\nu >> 3$-4 GeV, some remarks about the hadronic behaviour of photons are presented.

25389 **(CEA-CONF—9202) Study of strangeness in light nuclei: perspectives in (e, e').** Babinet, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). Jun 1987. 20p. (In French). (CONF-8706251—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752221/JAW.

From Workshop on intermediate energies; Grenoble, France (3 Jun 1987).

This report is aimed at showing the specific interest of the electromagnetic way of hypernuclei study which justifies its choice though the weak value of the cross sections. The different experimental methods currently in view are detailed: real photon, electroproduction at large angle and electroproduction by quasi-real photon at degree zero. Finally, conclusions to foresee of such a program are recalled and beam and experimental equipment characteristics are recalled.

25390 **(DOE/ER/40093—T1-Vol.8) Physics through the 1990s: Nuclear physics.** (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 232p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88006397/JAW.

This volume is the report of the Panel on Nuclear Physics of the Physics Survey Committee, established by the National Research Council in 1983. The report presents many of the major advances in nuclear physics during the past decade, sketches the impacts of nuclear physics on other sciences and on society, and describes the current frontiers of the field. It concludes with a chapter on the recommended priorities for this discipline.

25391 **(GSI—87-9a) Appendix to the report of the Committee on 'Nuclear Physics and Heavy Ion Research' 1983-1985.** (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Apr 1987. 151p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88752232/JAW.

In the appendix to the scientific report of the research project of the West German Ministry of Research and Technology on 'Nuclear physics and heavy ion research', publications are compiled which have been published on individual projects in the three years of research. Only articles from journals were included, in order to keep the size of this index within reason. The table is compiled in alphabetical sequence of the universities involved.

25392 (INP—1268/PL, pp 23-50) **Gamow-Teller rasonances and Δ production in nuclei.** Ellegaard, C. (Niels Bohr Inst., Copenhagen (Denmark)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The giant Gamow-Teller states in nuclei are studied through the (/sup 3/He,t) reaction at energies from 600 MeV to 2.3 GeV. The Gamow-Teller transition in the quark picture can lead to the excitation of the nucleon to the Δ-resonance. At /sup 3/He energies above 1.5 GeV the direct Δ excitation is observed both for the proton and for nuclei. The problem of missing strength in the observed Gamow-Teller states is addressed both in terms of mixing of the 1p - 1h states into 2p - 2h states and in terms of a renormalization through admixture of the Δ excitation. 9 refs., 34 figs.

25393 (INP—1268/PL, pp 227-245) **Evolution of the nucleus-nucleus interaction in the transition energy region.** Harar, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Basse Energie). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

An attempt is made to find out an answer to the following questions: how the reaction mechanisms behave with projectile mass and energy, what are the limits of the complete fusion, can we heat the nuclear matter up to the boiling point, at what energy the projectile fragmentation requirement occurs? 14 refs., 12 figs. (A.S.).

25394 (JAERI-M—86-080, pp 47-63) **Evaluation of threshold reaction data.** (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE86901587/JAW. (NEANDC(J)—120/U; INDC(JPN)—106/L; CONF-8511220—).

From Seminar on nuclear data; Tokai, Japan (12 Nov 1985).

In the present working group, we investigate the experimental data systematics, the calculational methods and the theoretical model parameters which are common in the evaluation of structural materials cross sections. The activities of a working group are briefly reviewed.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 25398

6512 Nuclear Properties And Reactions, A=1-5, Experimental

25395 **(CEA-CONF—9200) Electromagnetic interactions on light nuclei.** Platchkov, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie). Jun 1987. 9p. (CONF-8706251—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752222/JAW.

From Workshop on intermediate energies; Grenoble, France (3 Jun 1987).

In this contribution I will discuss the experimental results obtained for the two- and three-nucleon elastic form-factors. These observables have been recently studied up to momentum transfers of the order of 1 (GeV/c)/sup 2/. The data obtained permit now a very careful discussion of the present status of the theory in this momentum transfer region. For instance it has been found that the purely nucleonic contribution is by far unable to explain neither the charge nor the magnetic experimental form factors. The few-nucleon form-factors thus provide us with one of the most convincing evidences for the importance of the meson exchange currents (MEC) in the electromagnetic processes. For most of the processes described below the contribution of MEC is large and significantly improves the agreement between theory and experiment. Still, the situation is not yet perfect; other degrees of freedom such as three-body forces, relativistic effects or quark clusters are likely to contribute. Contrary to MEC, the relative importance of each of these effects is not settled yet. In the following, the present achievements and limitations in the understanding of the few-nucleon form factors will be reported.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

25396 **(ATOMKI-A—25(1987)) Complex scaling in the cluster model. Resonances in /sup 8/Be.** Kruppa, A.T.; Lovas, R.G.; Gyarmati, B. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701787/JAW.

Submitted to Phys. Rev., C (US).

To find the positions and widths of resonances, a complex scaling of the intercluster relative coordinate is introduced into the resonating-group model. In the generator-coordinate technique used to solve the resonating-group equation the complex scaling requires minor changes in the formulae and code. The finding of the resonances does not need any preliminary guess or explicit reference to any asymptotic prescription. The procedure is applied to the resonances in the relative motion of two ground-state α clusters in /sup 8/Be, but is appropriate for any systems consisting of two clusters. (author) 23 refs.; 5 figs.

25397 **(CEA-CONF—9201) Hypernuclei and baryon-baryon interaction.** Catz, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie). Jun 1987. 8p. (In French). (CONF-8706251—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752219/JAW.

From Workshop on intermediate energies; Grenoble, France (3 Jun 1987).

This conference, after a brief review on current knowledge on hyperon-nucleon interaction, discuss the last experimental results got in Λ and Σ hypernuclei and their consequences on hyperon nucleon interaction. Two experiments will conclude aimed at the study of dibaryons with strangeness of - 1 and -2.

25398 **(CONF-8708202—6) Oxygen-induced reactions at 60 A GeV and 200 A GeV studied by calorimetry.** Sorensen, S.P.; Albrecht, R.; Awes, T.C.; Baktash, C.; Beckmann, P.; Berger, F.; Bock, R.; Claesson, G.; Dragon, L.; Ferguson, R.L. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Muenster Univ. (Germany, F.R.); Lawrence Berkeley Lab., CA (USA); Lund Univ. (Sweden)). 12 Nov 1987. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006410/JAW.

From Quark matter '87: 6th international conference on ultra-relativistic nucleus-nucleus collisions; Schloss Nordkirchen, F.R. Germany (24 Aug 1987).

Results based on calorimetric measurements are presented from reactions of 60 A GeV and 200 A GeV ^{16}O projectiles with C, Cu, Ag, and Au nuclei. Minimum-bias cross sections are discussed. Energy spectra measured at zero degrees and transverse-energy distributions for the pseudorapidity range 2.4 ≦ eta ≦ 5.5 are shown. An analysis of the average transverse energy in terms of the number of participating nucleons and the number of binary nucleon-nucleon collision is presented. Estimates of nuclear stopping and of attained energy densities are made. 22 refs., 6 figs., 3 tabs.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

25399 (INIS-BR—934, pp 14) **Identification of transfer mechanisms followed by emission and sequential decay of the projectile in /sup 16/O+ /sup 28/Si, /sup 16/O+ /sup 27/Al and /sup 10/B+/sup 7/Al systems at energies from 4 to 5 MeV/A.** Carlin Filho, N.; Coimbra, M.M.; Added, N.; Anjos, R.M. dos; Fante Junior, L.; Figueira, M.C.S.; Guimaraes, V.; Szanto, E.M.; Toledo, A.S. de; Civitarese, O. (Sao Paulo Univ. (Brazil). Inst. de Fisica; CONICET (Argentina)). 1987. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88701471/JAW. (CONF-8708216—).

From 10. workshop on nuclear physics in Brazil; Caxambu, MG, Brazil (26 Aug 1987).

25400 **(INIS-mf—11104) Channel cross correlations and intermediate structure in the /sup 27/Al(d,p)/sup 28/Al,/sup 27/Al(d,α)/sup 25/Mg, /sup 31/P(d,p)/sup 32/P, and /sup 31/P(d,α)/sup 29/Si reactions.** Yeh Shew Ching. (Universidad Autonoma de Madrid (Spain). Dept. de Fisica Teorica). 1987. 69p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701932/JAW.

The excitation functions for protons and alpha particles from the reactions /sup 27/Al(d,p)/sup 28/Al, /sup 27/Al(d,α)/sup 25/Mg, /sup 31/P(d,p)/sup 32/P, /sup 31/P(d,α)/sup 29/Si in the range E/sub d/=3.5-6.2 MeV and for Θsub(lab)=90/sup 0/ and 160/sup 0/ were measured and analysed by the channel cross correlation function and autocorrelation function in order to obtain the correlating number n/sub d/, the average total level widths $<\Gamma\mu>$ and the level-overlapping ratio $<\Gamma\mu/D>$, where D is the average level spacing of spin zero states. Using these values the theoretical intermediate widths $<\Gamma\alpha>$ was calculated to be 206 keV and 158 +- 25 keV for deuteron reactions on /sup 27/Al and /sup 31/P respectively, which, within the errors, are consistent with the experimental results 200+-37 keV for deuteron reactions on /sup 27/Al and 198+-34keV for deuteron reactions on /sup 31/P. In addition, the value of n/sub d/(n/sub d/-1)/n/sup 2/ (the ratio of the number of correlating channels n/sub d/ to the number of open channels n) was determined to be 0.3 for deuteron reactions on /sup 27/Al and 0.27 for deuteron reactions on /sup 31/P, which is quite close to the theoretical predictions, 0.25+-0.05 and respectively 0.28+-0.04 for the above reactions.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

25401 (INP—1268/PL, pp 65-73) **Double γ decay in /sup 40/Ca and /sup 90/Zr.** Kroth, R.; Habs, D.; Schirmer, J.; Kwong, N.; Schwalm, D.; Zirnbauer, M.; Broude, C. (Heidelberg Univ. (Germany, F.R.). Pathologisches Inst.; Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.); Weizmann Inst. of Science, Rehovoth (Israel)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The double γ decay of the first excited 0/sup +/ state in /sup 40/Ca and /sup 90/Zr has been measured with the crystal ball. The perturbing background of positron annihilation in flight could be filtered out in analysis. Branching ratios of Γ/sub γγ//Γ/sub tot/(4.5 +- 1.0) x 10/sup -4/ and (1.8 +- 0.3) x 10/sup -4/ were obtained for /sup 40/Ca and /sup 90/Zr, respectively. In both cases the directional correlation of the two photons is asymmetric around 90deg, which is explained by an interference of 2E1 and 2M1 transitions. The linear polarization indicates a dominant 2E1 contribution in /sup 90/Zr, whereas in /sup 40/Ca the 2M1 decay is found to be dominant. 10 refs., 7 figs.

25402 **Bound-nucleon response functions from the reaction /sup 40/Ca(e,e'p)/sup 39/K and nuclear-medium effects.** Reffay-Pikeroen, D.; Bernheim, M.; Boffi, S.; Capitani, G.P.; De Sanctis, E.; Frullani, S.; Garibaldi, F.; Gerard, A.; Giusti, C.; Jackson, H.; and others. (Service de Physique Nucleaire-Haute Energie, Centre d'Etudes Nucleaires de Saclay, 91191 Gif-sur-Yvette Cedex, France). *Physical Review Letters;* **60**: No. 9, 776-779(29 Feb 1988).

Longitudinal and transverse structure functions for the quasielastic reaction /sup 40/Ca(e,e'p)/sup 39/K/sup */ have been obtained. Their q dependences appear like those for free nucleons. However, the ratio of the longitudinal to transverse structure functions is found reduced by 30% relative to theoretical calculations.

25403 **Observation of a nonspherical pion source in relativistic heavy-ion collisions.** Chacon, A.D.; Bistirlich, J.A.; Bossingham, R.R.; Bowman, H.R.; Clawson, C.W.; Crowe, K.M.; Humanic, T.J.; Kurck, J.M.; Meyer, C.A.; Rasmussen, J.O. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **60**: No. 9, 780-783(29 Feb 1988). Contract FG03-87ER40323;AC03-76SF00098.

The intensity interferometry method has been used to measure pion-source parameters in the reaction 1.70A-GeV /sup 56/Fe+Fe→$2\pi^-$+X. The parameters show an oblate source for a narrow-acceptance spectrometer near either 0° or 90° with respect to the beam axis in the center-of-mass frame. Intranuclear-cascade—model predictions show similar behavior and are compared to the experimental results.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

25404 **(GSI—87-63-Prepr.) Beta- and gamma-decay studies of neutron-rich chromium, manganese, cobalt and nickel isotopes including the new isotopes /sup 60/Cr and /sup 60g/Mn.** Bosch, U.; Schmidt-Ott, W.D.; Runte, E.; Tidemand-Petersson, P.; Koschel, P.; Meissner, F.; Kirchner, R.; Klepper, O.; Roeckl, E.; Rykaczewski, K. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.). Oct 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752045/JAW.

A 36 mg/cm/sup 2/ thick /sup nat/W target was irradiated with 11.5 MeV/u /sup 76/Ge of 15 to 20 particle + nA beam intensity. On-line mass-separated samples of projectile-like neutron-rich products from multi-nucleon transfer-reactions were investigated in the region of mass 58-69 by β- and γ-ray spectroscopy. The new isotope /sup 60/Cr was identified with a half-life of 0.57(6) s and for the /sup 60/Mn ground-state a half-life value of 51(6) s was obtained. Decay schemes were constructed for /sup 58/Cr, /sup 58/Mn (t/sub 1/2/ = 3 s), /sup 65,66,67/Co and /sup 69/Ni. One new γ-ray was found in the decay of /sup 59/Cr. The Q/sub β/-value of /sup 66/Co was measured yielding 9.7(5) MeV. The comparison of the measured new β-half-life of /sup 60/Cr with the most recent predictions gave again an enhancement of the experimental value.

25405 (INIS-BR—934, pp 5) **Nuclear fusion in /sup 12/C + /sup 63/-/sup 65/Cu systems.** Rocha, C.A.; Pereira, D.; Chamon, L.C.; Silva, C.P. da; Sala, O.; Ramirez, G. (Sao Paulo Univ. (Brazil). Inst. de Fisica; Chile Univ., Santiago. Facultad de Ciencias). 1987. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88701471/JAW. (CONF-8708216—).

From 10. workshop on nuclear physics in Brazil; Caxambu, MG, Brazil (26 Aug 1987).

25406 (INP—1268/PL, pp 130-153) **Lifetime measurements on high spin states in A ~= 80 nuclei.** Lieb, K.P. (Goettingen Univ. (Germany, F.R.). 1. Physikalisches Inst.). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Improvements in the techniques of lifetime measurements in medium-weight nuclei are discussed. Experimental results on transition and level energies or electromagnetic transition probabilities in neutron deficient Br, Kr, Rb and Sr isotopes are summarized and compared with several nuclear model calculations. The very large deformations found for the very light Kr, Rb and Sr isotopes,the role of (2qp) excitation on the B(E2) values, the possible effect of boson cut-off at high spin and the polarization effect of an unpaired g/sub 9/2/ proton on the respective core are also discussed. New results on quasi-bands in /sup 75/Br, /sup 77/Kr and /sup 77/Rb are presented. 50 refs., 17 figs.

25407 (JAERI-M—86-080, pp 30-46) **Fission-product cross section evaluation, integral tests and adjustment based on integral data.** Watanabe, T.; Iijima, S.; Kawai, M. (Japanese Nuclear Data Committee, Tokai, Ibaraki; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE86901587/JAW. (NEANDC(J)—120/U; INDC(JPN)—106/L; CONF-8511220—).

From Seminar on nuclear data; Tokai, Japan (12 Nov 1985).

Recent activities made by Fission-Product Nuclear Data Working Group in JNDC were briefed. This review consists of following three parts. 1. The JENDL-2 fission product data file was recently completed (Ref. 1) which contains neutron cross sections for 100 nuclides from Kr to Tb. The evaluation was made by using the latest data of capture cross sections and resonance parameters. The optical model parameters and level density parameters were re-evaluated. The results of the previous integral tests using the data of the STEK sample reactivity and CFRMF sample activation were also reflected on the evaluations. Details are reported in Ref. (2 -- 4). 2. The integral test of JENDL-2 fission-product cross sections is now in progress using the EBR-II sample irradiation data and the STEK and CFRMF data. The 70 group constants were generated by MINX code with the self-shielding factor tables. The values of the normal and adjoint fluxes and their uncertainties necessary for 70 group evaluation were obtained by spline fitting interpolation using the value of Ref. (14). 3. The adjustment of evaluated cross sections based on the integral data is also in progress using the Bayesian least-square method. The data adjustment will be made especially to (1) the nuclides which only integral data are available (e.g., Xe-131, 132, 134, Pm-147, Eu-152, 154) and to (2) those which the differential and integral data are mutually inconsistent (e.g., Tc-99, Ag-109, Eu-151, 153). The cross section covariances are generated by the "strength function model" taking into account of the statistical model uncertainty (Ref. 5). The uncertainties of neutron spectra and adjoint spectra were also taken into account as the "method uncertainties". Interium results of integral test and adjustment are presented and discussed. The near-future scope of the work and the plan for JENDL-3 are briefly described.

25408 **(KFK—4318-B) Nuclear moments and isotopic variation of the mean square charge radii of strontium nuclei by atomic beam laser spectroscopy.** Chongkum, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Physik). Oct 1987. 82p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88752263/JAW.

Hyperfine structure and optical isotope shift measurements have been performed on a series of stable and radioactive strontium isotopes (A = 80 to 90), including two isomers 85m and 87m. The spectroscopy applied continuous wave dye laser induced fluorescence of free atoms at λ=293.2 nm in a well collimated atomic beam. The 293.2 nm ultraviolet light was generated by frequency doubling the output of a dye laser in either a temperature tuned Ammonium Dihydrogen Arsenate (ADA) crystal or an angle tuned Lithium Iodate crystal. A special radio frequency (rf) technique was used to tune the dye laser frequency with long term stability. Radioactive Sr isotopes were produced either by neutron capture of stable strontium or by (α,xn) reactions from krypton gas. The samples were purified by an electromagnetic mass separator and their sizes were of order 100 pg, which corresponds to 10/sup 11/ atoms. The observed results of the hyperfine structure components are evaluated in terms of nuclear magnetic dipole moments and electric quadrupole moments. Changes in mean square charge radii of strontium nuclei which were extracted from the isotope shift measurements, exhibit a distinct shell effect at the neutron magic number N=50. The experimental data are analysed and compared with some theoretical nuclear model predictions. The strong increase of the nuclear charge radii with decreasing neutron number of isotopes below N=50 is in agreement with the variation of the mean square deformation extracted from measured B(E2) values.

25409 **Is the region above ^{78}Ni doubly magic?.** Hill, J.C.; Winger, J.A.; Wohn, F.K.; Gill, R.L.; Piotrowski, A.; Ji, X.; Wildenthal, B.H. (Ames Laboratory and Iowa State University, Ames, IA 50011). *AIP (American Institute of Physics) Conference Proceedings;* **164**: No. 1, 375-384(10 Dec 1987). (CONF-870970—). Contract W-7405-ENG-82;AC02-76CH00016.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

The region above ^{78}Ni would be doubly magic if the numbers Z = 28 and N = 50 retain their magic character far to the neutron-rich side of the stability. We report results of a study of the states in ^{82}Ge (^{78}Ni core+4 protons) and ^{83}As (^{78}Ni core+5 protons) populated in the β^- decay of ^{82}Ga and ^{83}Ge, respectively. Mass separated sources were produced at the TRISTAN separator facility. The measured level schemes were compared to shell-model calculations in which we assume an inert ^{78}Ni core and extra-core protons that are allowed to fill with minor restrictions all orbits between Z = 28 and 50. The calculations are generally in good agreement with the measurements except for a level in ^{83}Ge at 711 keV which cannot be easily explained. Finally the degree to which ^{78}Ni can be considered a valid doubly magic core is discussed.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

25410 **(ATOMKI-A—24(1987)) Level structure of /sup 110/In from the /sup 110/Cd(p,nγ)/sup 110/In reaction.** Krasznahorkay, A.; Fenyes, T.; Timar, J.; Kibedi, T.; Passoja, A.; Julin, R.; Kumpulainen, J. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete; Jyvaeskylae Univ. (Finland). Dept. of Physics). (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1987. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701786/JAW.

Submitted to Nucl. Phys. (US).

γ-ray and γγ-coincidence spectra of the /sup 110/Cd(p,nγ)/sup 110/In reaction were measured with Ge(Li), Ge(LEPS), and Ge(HP) spectrometers at 6 MeV bombarding proton energy. Energies and relative intensities of 95 /sup 110/In transitions (including 70 new ones) are determined. The electron spectrum of the reaction was measured with a combined magnetic plus Si(Li) spectrometer at E/sub p/=6 MeV. The angular distribution of γ-rays was measured at 5.2, 5.6, and 6 MeV bombarding proton energies. A new, more complete level scheme of /sup 110/In has been deduced. The comparison of experimental and theoretical results provided identification of about 20 p-n multiplet states in /sup 110/In.

25411 **(GSI—87-16) Emission of high-energy photons in deep inelastic heavy ion collisions.** Herrmann, N. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Heidelberg Univ. (Germany, F.R.)). Sep 1987. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752234/JAW.

For the answer of the question which mechanism is responsible for the production of high-energy photons in heavy ion reactions high-energy photons in coincidence with binary and ternary reactions in the system /sup 92/Mo+/sup 92/Mo were measured at an incident energy of 19.5 MeV/u. The occurring reactions were kinematically reconstructed and allowed a good characterization of the events. The main part of the reaction cross section is at this incident energy filled up by two- and three-body reactions and allows a simple determination of the total excitation energy which is partitioned to the fragments. Because in the case of the two-body reaction also the reaction plane is well determinable the photon distributions could for the first time be systematically studied on dependencies on the dissipated energy and the orientation to the reaction plane. (orig./HSI).

25412 (INP—1268/PL, pp 51-64) **Isomers and the shell model in proton rich A ~ 150 nuclei.** Broda, R. (Institute of Nuclear Physics, Krakow (Poland)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Nuclei, which in the nuclear chart are located above the /sup 146/Gd, moving along the N=81, 82 lines into the even more proton rich region up to the proton drip line are discussed. The scope of this paper is limited to a fairly well understood level structure at relatively low spin and excitation energy, although the programme pursued by the purdue group is much broader. 10 refs., 11 figs.

25413 (INP—1268/PL, pp 392-397) **10/sup +/ states in the N = 80 nucleus /sub 62//sup 142/Sm/sub 80/.** Lach, M.; Styczen, J.; Beuscher, H.; Kleinheinz, P.; Blomqvist, J. (Institute of Nuclear Physics, Krakow (Poland); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Research Institute of Physics, Stockholm (Sweden)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

/sup 142/Sm was investigated through (α,4n) and (/sup 3/He,3n) reactions. In the experiments ≧ 60 MeV α-particles and 32 to 50 MeV /sup 3/He beams were used. The γ-ray excitation functions and angular distributions were measured and detailed four-parameter γγ-coincidence experiments with 140 ns separated beam bursts were carried out. These data establish the /sup 142/Sm level scheme up to 6 MeV and I=16. Our data confirm the earlier tentative assignment for the 3.662 MeV isomer and we identify a second 10/sup +/ state at 3.825 MeV. The previously unknown isomeric half life was determined from the t/sub γγ/ data as T/sub 1/2/(10/sup +/,3.662 MeV)= 480 +- 60 ns; the same data give for the lower-lying 7/sup -/ isomer T/sub 1/2/(7/sup -/,2.372 MeV)175 +- 5 ns in close agreement with the earlier results. 13 refs., 2 figs., 1 tab.

25414 (INP—1268/PL, pp 401-403) **Medium and low-spin states in N = 82 +- 1 nuclei near /sup 146/Gd.** Piiparinen, M.; Komppa, T.; Komu, R.; Kortelahti, M.; Pakkanen, A. (Jyvaeskylae Univ. (Finland). Dept. of Physics). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The N=81 nuclei /sup 143/Sm and /sup 145/Gd as well as the N=83 nucleus /sup 147/Gd were studied using (/sup 3/He,xn) and (α,n) reactions. In-beam γ-ray and conversion electron spectroscopic methods were applied. About 15 new medium-spin states were observed in every nucleus studied. 4 refs., 1 fig.

25415 (INP—1268/PL, pp 405-407) **Proton h/sub 11/2//sup 1/ excitations in N = 82 nuclei.** Enghardt, W.; Jaeger, H.U.; Kaeubler, L.; Keller, H.J.; Prade, H.; Stary, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Levels of negative parity have been identified in several N=82 nuclei with 137 ≦ A ≦ 146. We tried to interprete the states of negative parity of a nucleus with Z protons outside the doubly magic system /sup 132/Sn in terms of a model which describes the coupling of one 1h/sub 11/2/ proton to $\pi = +1$ states in the core nucleus with (Z-1) valence protons. 11 refs., 2 figs., 1 tab.

25416 (JAERI-M—86-080, pp 80-85) **P/sub n/ values of /sup 94/Rb and /sup 95/Rb measured by a β-γ spectroscopic method.** Okano, K.; Kawase, Y.; Funakoshi, Y. (Kyoto Univ., Kumatori, Osaka, Japan. Research Reactor Inst.; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE86901587/JAW. (NEANDC(J)—120/U; INDC(JPN)—106/L; CONF-8511220—).

From Seminar on nuclear data; Tokai, Japan (12 Nov 1985).

The delayed neutron emission probabilities (P/sub n/ values) of /sup 94/Rb and /sup 95/Rb have been measured as (9.73 +- 0.62) % and (8.60 +- 0.57) %, respectively, by a β-γ spectroscopic method utilizing the on-line isotope separator KURISOL. This method can be usefully applied if a pure isotopic and mass-separated ion beam is available and the absolute emission probabilities per decay of main γ rays emitted from relevant nuclides are well established.

25417 **Nilsson orbitals and rotational bands of deformed A≅100 nuclei.** Wohn, F.K.; Hill, J.C.; Winger, J.A.; Petry, R.F.; Goulden, J.D.; Gill, R.L.; Piotrowski, A.; Mach, H. (Ames Laboratory, Iowa State University, Ames, IA 50011). *AIP (American Institute of Physics) Conference Proceedings;* **164**: No. 1, 407-410(10 Dec 1987). (CONF-870970—). Contract W-7405-ENG-82;AS05-79ER10495;AC02-76CH00016.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

Highly deformed Rb, Sr, Y, Zr and Nb isotopes are being studied using the TRISTAN facility at BNL. γ-spectroscopic studies of the β decays of /sup 99//sup —//sup 102/Sr to their odd-ZY daughters have been completed and studies of the β decays of ^{99}Rb and /sup 101/Y are nearing completion. This report summarizes our results on /sup 99//sup —//sup 102/Sr decays, then fo-

cuses on experimental or theoretical results for certain Nilsson orbital assignments. In particular, the Nilsson assignments for the ground state of ^{99}Rb and 536-keV K = 3/2 band in ^{99}Y are discussed.

25418 **Decay studies of neutron deficient rare earth isotopes with OASIS.** Gilat, J.; Nitschke, J.M.; Wilmarth, P.A.; Vierinen, K.; Firestone, R.B. (Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *AIP (American Institute of Physics) Conference Proceedings;* **164**: No. 1, 463-472(10 Dec 1987). (CONF-870970—). Contract AC03-76SF00098.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

We report results on the decay of /sup 124/Pr, /sup 124,125/Ce, /sup 124,125/La, /sup 134//sup —//sup 136/Eu, /sup 134//sup —//sup 136/Sm, /sup 134//sup —//sup 136/Pm, /sup 144/Ho, /sup 141,142,144/Dy, /sup 140,141,142,144/Tb, /sup 140//sup —//sup 142/Gd, and /sup 140//sup —//sup 142/Eu, produced by /sup 92/Mo(H.I.,xpyn) reactions at the Berkeley SuperHILAC, and studied with the OASIS on-line mass separator facility. Half-lives, delayed proton branching ratios, γ-ray energies and intensities, partial decay schemes and several J/sup π/ assignments are presented. Level systematics of the even mass Nd and Sm isotopes and the νh/sub 11/2/-νs/sub 1/2/ isomers for N = 77 are discussed.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

25419 **(CRN-PN—87-06) Search for Correlations between Prolate-Shape Collective and Oblate-Shape Non-Collective Nuclear Rotation: High Spin States in /sup 159,160/ Yb.** Byrski, T.; Beck, F.A.; Sharpey-Schafer, J.F.; Simpson, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1987. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752192/JAW.

High-spin states of /sup 159,160/ Yb have been studied using the escape-suppressed array TESSA 2. Extensions of yrast and lateral bands have been found up to I ~40. Experimental data suggest strong correlations between maximum alignment configurations of the valence nucleons and related collective states. Theoretical analysis fully supports the idea of prolate-collective vs. oblate-non-collective correlations. Band termination interpretation is discussed.

25420 **(GSI—87-69-Prepr.) Beta-decay of 27/2/sup -/ isomers in N=83 nuclei.** Barden, R.; Plochocki, A.; Schardt, D.; Kirchner, R.; Klepper, O.; Rubio, B.; Ogawa, M.; Kleinheinz, P.; Blomqvist, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Forskningsinstitutet foer Atomfysik, Stockholm (Sweden)). Oct 1987. 21p. Also published in Z. Phys., A: At. Nuclei (Jan 1988) Vol. 329(1) p. 11-20.

In the N=83 nucleus /sup 151/Er we observed the isomeric E3 transition in conversion electron measurements following on-line mass separation and located its 0.6 s 27/2/sup -/ isomer at 2.586 MeV. Gamma-ray data establish a 4.7(3)% Gamow-Teller β-decay branch proceeding to high-spin states above 2 MeV excitation in /sup 151/Ho. A weak β-decay branch of 0.7(3)% was also observed for the 0.5 s 27/2/sup -/ isomer in the /sup 149/Dy isotone, and it was established that a similar 27/2/sup -/ E3-isomer does not occur in /sup 153/Yb. First results on the /sup 151/Tm and /sup 151/Er ground state β-decays are briefly discussed.

25421 (INP—1268/PL, pp 154-170) **Nuclear structure effects in the Dy nuclei at high excitation and low spin.** Rekstad, J.; Guttormsen, M.; Ramsoy, T.; Ingebretsen, F.; Thorsteinsen, T.F.; Lovhoiden, G.; Rodland, T. (Oslo Univ. (Norway). Fysisk Inst.; Bergen Univ. (Norway). Dept. of Physics). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

By means of particle-γ coincidence measurements the decay modes for highly excited low spin states in some Dy isotopes have been investigated. We have studied also: couplings between two-quasiparticle states and vibration in the energy region from 1.5 to 2.5 MeV, non-statistical cooling in the energy region from 2.5 to 6.5 MeV, the neutron emission from threshold up to approximately 40 MeV of excitation. 9 refs., 15 figs.

25422 (INP—1268/PL, pp 404) **Electromagnetic transition probabilities in the doubly odd N = 91 nucleus /sup 154/Eu.** Rotter, H.; Heiser, C.; Schilling, K.D.; Andrejtscheff, W.; Kostov, L.K.; Balodis, M.K. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika; Physics Institute, Riga-Salaspils (USSR)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The subnanosecond half-lives or upper half-life limits of several states in /sup 154/Eu excited in the (n,γ) reaction have been determined. From these data reduced transition probabilities B(λ) reaction have been derived. (M.F.W.).

25423 (INP—1268/PL, pp 417-421) **Prolate to oblate shape transition at high spin in the N = 88 isotones.** Azgui, F.; Emling, H.; Spreng, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

A recoil distance measurement performed on the /sup 156/Er isotope is described. The deduced lifetimes and feeding times are compared with results obtained earlier for the neighbouring Dy isotopes in the N=80-90 region. 11 refs., 1 fig.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

25424 **(HMI-P—87/10-HF-Prepr.) E2 polarization by protons and neutrons around /sup 208/Pb - quadrupole moments of high spin isomers in /sup 202/Bi.** Berger, A.; Grawe, H.; Shen, W.G.; Mahnke, H.E. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik; State Univ. of New York, Stony Brook (USA). Dept. of Physics). 1987. 6p. (CONF-8708123—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752241/JAW.

From International conference on nuclear structure through static and dynamic moments; Melbourne, Australia (25 Aug 1987).

The measured quadrupole moments of high-spin isomers in /sup 202/Bi are found to fully support the concept of E2 polarization of the core by valence particles and holes in both magnitude and relative sign.

25425 (INP—1268/PL, pp 441-443) **Retarded intramultiplet M1 transition in /sup 214/Bi.** Protochristow, Ch.; Andrejtscheff, W.; Penev, I.; Zhelev, Zh. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

New data on lifetimes of excited levels in /sup 214/Bi are presented and intramultiplet M1 transition rates in /sup 210/, /sup 212/, /sup 214/Bi are discussed. 5 refs., 2 figs. (M.F.W.).

25426 **(IPNO-DRE—87-23) Evidence for a change of structure in the Hg isotopes between A = 201 and A = 199.** Vergnes, M.; Berrier-Ronsin, G.; Rotbard, G.; Vernotte, J.; Maison, J.M.; Fortier, S. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752196/JAW.

An anomalous behaviour has already been observed in the even-even Hg isotopes around A = 200, for energies and B(E2). In the (p,t) reaction studied (simultaneously with the (p,d) reaction) using a 25 MeV proton beam from the Orsay MP tandem, both the energy and the cross section of the 0/sub 2//sup +/ level show striking extremum at A = 200. The (p,t) reaction has also been studied on the odd Hg targets. Besides the well known reduction, compared to the even-even targets, the L = 0 strength shows a very different behaviour for the two targets. The important splitting of the L = 0 strength in the reaction /sup 201/Hg -> /sup 199/Hg suggests an appreciable change of structure between /sup 201/Hg and /sup 199/Hg. This change is reminiscent of the one previously observed in the Ga isotopes between /sup 71/Ga and /sup 73/Ga. The change is also evident in the sudden variation in the ordering and in the general compression of the levels when going from /sup 199/Hg to /sup 201/Hg, opposed to a quite regular behaviour of the energies between /sup 193/Hg and /sup 199/Hg. This upheaval is even more striking when considering the present values of the spectroscopic factors in the (p,d) reaction on the even-even Hg targets.

25427 **Nuclear structure effects on α reduced widths.** Toth, K.S.; Ellis-Akovali, Y.A.; Kim, H.J.; McConnell, J.W.; Carter, H.K.; Moltz, D.M. (Oak Ridge National Laboratory, Oak Ridge, TN 37831). *AIP (American Institute of Physics) Conference Proceedings;* **164**: No. 1, 665-674(10 Dec 1987). (CONF-870970—). Contract AC05-84OR21400;AC05-76OR00033.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

A review of α widths for s-wave transitions is presented together with a discussion of the following topics: 1) a new determination of the /sup 218/Ra half-life and its relation to reflection asymmetry in nuclei near N = 130, 2) a measurement of the /sup 194/Pb α-decay rate and the influence of the Z = 82 gap on neutron-deficient Pb nuclei and 3) an up-date of α-decay-rate systematics for isotopes in the rare earth and medium-weight mass regions.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

25428 **(GSI—87-17) Onset of dynamical fragmentation processes in heavy ion collisions at intermediate incident energies.** Trockel, R. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Heidelberg Univ. (Germany, F.R.)). Sep 1987. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752235/JAW.

For the study of the emission of medium heavy fragments which result from central collisions a series of experiments with a manifold of projectile-target combinations was performed. As projectiles served /sup 12/C, /sup 18/O, /sup 20/Ne and /sup 40/Ar in the incident energy range between 30 and 84 MeV per nucleon. As targets /sup 232/Th, /sup 197/Au, and /sup nat/Ag were applied. The systematic study of the inclusive energy spectra shows that light and medium heavy fragments cannot be emitted simultaneously from a common source but clear differences in the dependence of the temperature parameters on the projectile velocity and the increasement of the production cross sections are found. As the angular distribution of the medium heavy shows they are emitted before reaching a global equilibrium but in the mean later than the light particles. This is also confirmed by the behaviour of the relative isotope frequencies. The observations can be supported by correlation analyses. The multiplicity of the medium heavy fragments lies in the mean between one and two and increases strongly with energy deposed in the target. (orig./HSI).

25429 **(INIS-mf—11625) Cold fragmentation and mass and nuclear charge distributions as function of the kinetic energy in the reaction /sup 239/Pu(n/sub th/,f).** Schmitt, C. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich 5 - Physik). 11 Dec 1986. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752246/JAW.

In the present thesis on measurements of the mass distributions, nuclear charge distributions, and energy distributions of the light group of /sup 239/Pu(n/sub th/,f) fission products is reported which were performed at the mass separator 'Lohengrin' of the Laue-Langevin Institute in Grenoble. The measurements comprehended a mass range of 80 $\leqq$ A $\leqq$ 113. The studied energy range extended from 93 MeV up to kinetic energies which correspond to the Q-values of the mass splits. (HSI).

25430 (INP—1268/PL, pp 335-370) **Positron spectroscopy of supercritical heavy ion collision systems.** Bokemeyer, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Narrow peak structures at ~300 keV have been observed in the positron spectra of supercritical collision systems. There remains only little possibility that these structures can be associated with nuclear deexcitation of the separated collision products. Emmited from systems both existing for >10/sup -20/ sec and apparently moving with the velocity of the center of mass these positrons may represent candidates for the process of spontaneous positron emmision from metastable di-nuclear quasiatoms although straight-forward scaling of supercritical binding with the combined charge of the colliding nuclei does not agree with the observed energies. 49 refs., 19 figs.

25431 **(IPNO-DRE—87-24) Discovery of the radioactive decay of /sup 223/Ra by /sup 14/C emission and experiments with the magnetic spectrometer Soleno.** Hourani, E.; Hussonnois, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752195/JAW.

The aim of this report is to review the experiment of Rose and Jones (discovery in 1984 of radioactive decay of /sup 223/Ra by /sup 14/C nuclei emission) with the subsequent one of Alexandrov (et al) performed with the same technique. The experiments performed by the group at Orsay on /sup 14/C radioactivity of radium isotopes with the magnetic spectrometer Soleno are also reviewed. This review comprises the presentation and comments of the original results and arguments taken in their historical context.

25432 (JAERI-M—86-080, pp 213-227) **Nuclear data evaluation for heavy nuclides.** Nakagawa, Tsuneo. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE86901587/JAW. (NEANDC(J)—120/U; INDC(JPN)—106/L; CONF-8511220—).

From Seminar on nuclear data; Tokai, Japan (12 Nov 1985).

The simultaneous evaluation for the fission cross section of /sup 235/U, /sup 238/U, /sup 239/Pu, /sup 240/Pu and /sup 241/Pu, and the capture cross sections of /sup 197/Au and /sup 238/U was performed by the JNDC Subworking Group on Heavy Nuclide Data. The evaluated data was obtained in the energy range from 50 keV to 20 MeV by means of the generalized least-squares method and the B-spline functions. The presently obtained fission cross sections of /sup 235/U and /sup 239/Pu are a few percent smaller than the JENDL-2 data in the energy range below 1 MeV.

25433 **Identification of new neutron-rich rare-earth isotopes produced in /sup 252/Cf spontaneous fission.** Greenwood, R.C.; Anderl, R.A.; Cole, J.D.; Lee, M.A.; Willmes, H. (Idaho National Engineering Laboratory, EG&G Idaho Inc., Idaho Falls, ID 83415). *AIP (American Institute of Physics) Conference Proceedings;* **164**: No. 1, 782-785(10 Dec 1987). (CONF-870970—). Contract AC07-76ID01570.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

New neutron-rich isotopes of several rare-eath elements have been identified using the /sup 252/Cf-based ISOL facility at the INEL. New isotopes observed to date, with values of their half-lives in parentheses, are /sup 153/Pr (4.28 +- 0.11 s), /sup 155/Nd (8.9 +- 0.2 s), /sup 156/Nd (5.47 +- 0.11 s), /sup 157/Pm (10.50 +- 0.12 s), /sup 158/Pm (4.8 +- 0.5 s), /sup 162/Eu (10.6 +- 1.0 s) and /sup 164/Gd (45 +- 3 s). Also, new half-life values have been measured for /sup 151/Pr (18.90 +- 0.07 s), /sup 152/Pr (3.7 +- 0.2 s), /sup 153/Nd (28.9 +- 0.4 s), /sup 154/Nd (25.9 +- 0.2 s), / sup 153/Pm (315 +- 1 s), /sup 155/Pm (41.5 +- 0.2 s), /sup 156/ Pm (26.70 +- 0.10 s), /sup 157/Sm (483 +- 2 s), /sup 158/SM (318 +- 2 s), /sup 159/Sm (11.37 +- 0.15 s), /sup 160/Sm (9.6 +- 0.3 s) and /sup 161/Eu (24 +- 4 s). The half-life values are compared to the results of theoretical predictions.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 25270, 25294, 25396, 25400, 25400

25434 **(GSI—87-61-Prepr.) On the fission of the heaviest fermium isotopes.** Cwiok, S.; Rozmej, P.; Sobiczewski, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Politechnika Warszawska (Poland). Inst. Fizyki). Oct 1987. 7p. (CONF-870970—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752025/ JAW.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

Potential energy of /sup 258/Fm is calculated in multidimensional deformation space as a function of both (reflection-)symmetric and asymmetric shapes. The inclusion of the asymmetric shapes is found important as it 'opens a pass' between the two fission valleys: one corresponding to compact and the other to elongated shapes of the nucleus. Thus, it makes both valleys accessible to the fissioning nucleus.

25435 **(GSI—87-72-Prepr.) Nonlinearity of the scalar field in a relativistic mean-field theory of the nucleus.** Reinhard, P.G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Oct 1987. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752239/JAW.

The form of the nonlinear selfcoupling of the scalar meson field in a nuclear relativistic mean-field theory is investigated. The conventional ansatz is shown to produce instabilities in critical applications. A modified selfcoupling is proposed which guarantees stability under all conditions.

25436 **(IC—86/350) Solitary wave exchange potential and nucleon-nucleon interaction.** Prema, K.; Raghavan, S.S.; Sekhar Raghavan. (International Centre for Theoretical Physics, Trieste (Italy); Regional Coll. of Education, Mysore (India); Designs and Prototypes, Adyar, Madras (India)). (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701836/JAW.

Nucleon-nucleon interaction is studied using a phenomenological potential model called solitary wave exchange potential model. It is shown that this simple model reproduces the singlet and triplet scattering data and the deuteron parameters reasonably well. (author). 6 refs, 2 figs, 1 tab.

25437 **(IC—86/370) Form factors and transition charge densities for the quadrupole and hexadecupole electroexcitation of some 2p-1f shell nuclei.** Raina, P.K.; Sharma, S.K. (Indian Inst. of Tech., Kanpur. Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701840/JAW.

A microscopic description of the recent data on the inelastic electron scattering form factors for the O/sup +/ -> 2/sup +/ as well as O/sup +/ -> 4/sup +/ transitions in some doubly even Ti, Cr, Fe, Ni and Zn isotopes is attempted in terms of the projected Hartree-Fock-Bogolubov wave functions resulting from realistic effective interactions operating in the 2p-1f shell. It turns out that the available form factor data out to about 2.5fm/sup -1/ can be reproduced in most of the cases in a fairly satisfactory manner in terms of reasonable values of effective charges. It is seen that the empirical transition charge densities in Ni and Zn isotopes extracted from the form factor data via the Fourier-Bessel analysis play a decisive role vis-a-vis the choice of a model of core-polarization contributions. (author). 28 refs, 8 figs, 2 tabs.

25438 **(IC—86/371) Inelastic two composite particle systems scattering at high energy.** Zhang Yushun. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1986. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701841/JAW.

In this paper, by using the collective coordinate of Bohr and phenomenological deformed optical potentials, the scattering amplitudes of two composite particle systems can be obtained and the collective excitation for two composite particle systems in the scattering process is discussed. (author). 10 refs, 6 figs, 2 tabs.

25439 **(IC—86/380) Composite model approach to the / sub 2/He/sup 4/ nucleus ground state.** Mehrotra, I.; Agarwal, B.K. (International Centre for Theoretical Physics, Trieste (Italy); Allahabad Univ. (India). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701844/JAW.

Assuming that the nucleons are ($\pi\mu$) composite systems the helium nucleus is compared to a molecule consisting of four hydrogen-like atoms where pions are like nuclei and muons are like electrons. Ground state energy of /sub 2/He/sup 4/ nucleus has been estimated in the framework of valence-bond method. Good agreement with the experimental value can be obtained if it is assumed that μ/sup +/ μ/sup -/coupling is 3% stronger than the μ/sup +-/ μ/sup +-/ coupling. (author). 11 refs, 1 tab.

25440 **(IC—86/381) Study of strange-, charmed, and beauty nuclei.** Mehrotra, I.; Prema, K.; Agarwal, B.K. (International Centre for Theoretical Physics, Trieste (Italy); Allahabad Univ. (India). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701845/JAW.

An analyses is made of the bound states of nuclei in the strange-, charm-, and beauty sector using a spin-dependent Gaussian two-body interaction in the microscopic formalism. Coulomb corrections are also included for the charmed nuclei. Our simple model is in reasonable agreement with other existing theoretical and experimental results and it predicts many new bound states. (author). 21 refs, 2 figs, 10 tabs.

25441 **(IC—86/384) Onset of large deformations and the occurrence of anomalous high-spin yrast spectra in the Zr-Mo region.** Sharma, S.K.; Tripathi, P.N.; Khosa, S.K. (International Centre for Theoretical Physics, Trieste (Italy); Vikramjit Singh Sanatan Dharma Coll., Kanpur (India). Dept. of Physics; Jammu Univ. (India). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701848/JAW.

The observed dramatic onset of large deformations in the highly neutron-rich Zr and Mo isotopes is examined by carrying out self-consistent Hartree-Fock-Bogoliubov calculations employing

pairing-plus-quadrupole-quadrupole effective interactions operating in a reasonably large valence space outside an inert core. It turns out that the observed deformation systematics can be understood in terms of the polarization of the (2d/sub 5/2/)/sup 6/ part of the N=56 core initiated by the involvement of the 1h/sub 11/2/ orbit in the underlying valence space. A variational calculation of the high-spin yrast spectra in the highly neutron-rich Mo isotopes suggests strongly the possibility of observing the backbending effect. It turns out that the B(E2) values associated with the yrast spectra can provide unambiguous signatures of the large structural changes that are likely to occur in the high-spin yrast spectra of the nuclei in this new island of deformation. (author). 25 refs, 6 figs, 4 tabs.

25442 (IC—86/387) **Dynamical alpha-type correlations in deformed superfluid nuclei.** Carstoiu, F.; Apostol, M.; Bulboaca, I.; Dumitrescu, O.; Horoi, M. (International Centre for Theoretical Physics, Trieste (Italy); Institutul Central de Fizica, Bucharest (Romania)). (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701849/JAW.

By including an adequate four-particle interaction, correlations between the proton and neutron fluids in deformed nuclei are induced. As a result, superfluidities of the two nuclear systems may be generated by one another and the phase structure is enriched by a new superfluid phase dominated by alpha-type correlations. Among the consequences upon the nuclear structure and dynamics figure the prediction of new bands of elementary excitations and the increase of superfluid enhancement factors for alpha and pair transfer reactions. (author). 18 refs, 2 figs, 1 tab.

25443 (IC—87/137) **Double beta decay.** Ching Chengrui; Ho Tsohsiu; Wu Xingrong. (Academia Sinica, Beijing, BJ (China). Inst. of Theoretical Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701879/JAW.

In this paper, nuclear double beta decay processes with $\Delta -> \Delta$ mechanism are studied. The half-life of double beta decay for two-neutrino processes of several nuclei and estimates of the neutrino masses are given. It is shown that the theoretical half lives for two-neutrino processes given by this mechanism are consistent with the experimental data and that the upper limit of neutrino mass m/sub υ/ < 8.1 eV is a little less than that from Supernova SN1987a. (author). 7 refs, 3 tabs.

25444 (INIS-BR—934, pp 110) **Relativistic effects on the effective polarization in the quasi-free scattering.** Krein, G.; Maris, T.A.J.; Veit, E.A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1987. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88701471/JAW. (CONF-8708216—).

From 10. workshop on nuclear physics in Brazil; Caxambu, MG, Brazil (26 Aug 1987).

25445 (INIS-BR—934, pp 113) **Analytic one-dimensional model for an n-boson condensate showing saturation.** Merchant, A.C.; Isidro Filho, M.P. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1987. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88701471/JAW. (CONF-8708216—).

From 10. workshop on nuclear physics in Brazil; Caxambu, MG, Brazil (26 Aug 1987).

25446 (INIS-mf—10567, pp 63-90) **Nuclear structure on a Grassmann manifold.** De Wet, J.A. 1986. NTIS (US Sales Only), PC A12/MF A01. Order Number DE87701986/JAW. (CONF-8607120—; CONF-8507150—).

From 21. annual seminar on theoretical physics; Johannesburg, South Africa (8 Jul 1986).

The papers on the 20th and 21st annual seminars on theoretical physics are bound in one volume.

Products of particle-like representations of the homogeneous Lorentz group are used to construct the degrees of spin angular momentum of a composite system of protons and neutrons. If a canonical labelling system is adopted for each state a shell structure emerges. Furthermore the use of the Dirac ring ensures that the spin is characterized by half angles in accord with the neutron-rotation experiment. It is possible to construct a Clebsch-Gordan decomposition to reduce a state of complex angular momentum into simpler states which can be identified with α and β particles, multipole operators, etc. Finally ground state energy levels are calculated for all the even=even nuclei by using a differentiable manifold which is spin-graded and gauge-invariant by construction. It is shown that this manifold is Grassmann.

25447 (INIS-mf—10567, pp 129-145) **Charge and spin structure of nucleons.** Tegen, R. (Institute of Theoretical Physics and Astrophysics, University of Cape Town, South Africa). 1986. NTIS (US Sales Only), PC A12/MF A01. Order Number DE87701986/JAW. (CONF-8607120—; CONF-8507150—).

From 21. annual seminar on theoretical physics; Johannesburg, South Africa (8 Jul 1986).

The papers on the 20th and 21st annual seminars on theoretical physics are bound in one volume.

The experimental and theoretical possibility of probing nucleons with a 'heavy' lepton beam have been discussed. The quark core size can be constrained by the (remeasured) axial form factor G/sub A/(q/sup 2/), whereas the meson cloud (isoscalar and isovector) can be constrained by comparison to G/sub E,M//sup p,n/(q/sup 2/). Better data (possibly from a polarised muon scattering experiment) for G/sub E,M/(q/sup 2/) will considerably improve our understanding of the nucleon in terms of its spin-carrying (quark, Skyrmion) and spinless constituents (π/sup ->/,σ).

25448 (INIS-mf—10567, pp 151-171) **Conventional nuclear EMC effect in deep inelastic lepton-nucleus scattering.** Nakano, K.; Rafelski, J. (Institute of Theoretical Physics and Astrophysics, University of Cape Town, South Africa). 1986. NTIS (US Sales Only), PC A12/MF A01. Order Number DE87701986/JAW. (CONF-8607120—; CONF-8507150—).

From 21. annual seminar on theoretical physics; Johannesburg, South Africa (8 Jul 1986).

The papers on the 20th and 21st annual seminars on theoretical physics are bound in one volume.

A comprehensive investigation of the EMC effect based on conventional nuclear structure is presented. The ratio of deep inelastic lepton nucleon to lepton nucleus cross sections is shown to be sensitively dependent on the proper kinematics and the binding effect of nucleons in nuclei. The small Bjorken x region of the EMC effect remains unresolved. The example studied is /sup 40/Ca at -Q/sup 2/ = 20(GeV/c)/sup 2/.

25449 (INIS-mf—10567, pp 173-190) **Pressure ensemble and dense nuclear matter with finite size nucleons at zero temperature.** Schnabel, A.G.; Rafelski, J.; Eggers, H.C.; Cleymans, J. (Institute of Theoretical Physics and Astrophysics, University of Cape Town, South Africa). 1986. NTIS (US Sales Only), PC A12/MF A01. Order Number DE87701986/JAW. (CONF-8607120—; CONF-8507150—).

From 21. annual seminar on theoretical physics; Johannesburg, South Africa (8 Jul 1986).

The papers on the 20th and 21st annual seminars on theoretical physics are bound in one volume.

The aim of this study is to find the equations of state of dense nuclear matter near the phase transition of quark-gluon-plasma. The effect of finite particle volume on the equation of state is calculated for both a hard sphere and a variable size particle Fermi gas using the pressure ensemble formalism in statistical physics and the MIT bag model. It is found that for high baryon densities only the variable volume decription of the nuclear gas yields physically sensible results in that P/epsilon $< 1/3$. The equations of state of nuclear matter at several times normal nuclear density show properties similar to those found by other methods.

25450 (INP—1268/PL) **Selected topics in nuclear structure. Proceedings of 19 winter school, 3-15 April, 1984, Zakopane, Poland.** Stachura, Z. (ed.). (Institute of Nuclear Physics, Krakow (Poland)). Sep 1984. 468p. (CONF-8404157—). NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW.

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

19. winter school in Zakopane was devoted to selected topics in nuclear structure such as: production of spin resonances, heavy ions reactions and their applications to the investigation of high spin states, octupole deformations, excited states and production of new elements etc. The experimental data are ofen compared with theoretical predictions. Report contains 28 papers. (M.F.W.).

25451 (INP—1268/PL, pp 171-209) **Shape coexistence and high spin states in the A $\sim =$ 80 mass region.** Bengtsson, R.; Nazarewicz, W. (Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Experimental evidences for shape coexistence at low spin in nuclei in the A $\simeq$ 80 mass region are compared with theoretical predictions based on the Woods-Saxon potential. High spin states up to I = 50 Planck constant are calculated and some typical intrinsic structures and deformations associated with them are discussed. 15 refs., 24 figs.

25452 (INP—1268/PL, pp 246-268) **MONSTER: nuclear structure calculations in realistic model spaces.** Schmid, K.W.; Gruemmer, F.; Hammaren, E. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Jyvaeskylae Univ. (Finland). Dept. of Physics; Suomen Akatemia, Helsinki (Finland)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

A microscopic, particle-number and spin conserving nuclear structure model is discussed, which can describe excitation energies, moments, transitions and spectroscopic factors at low and high spins of odd-mass and doubly-even nuclei in all mass regions. Using a realistic two-body Hamiltonian extracted via a G-matrix description from nucleon-nucleon scattering data, the model is here applied to nuclei in the A=130 region. Furthermore the first results of an improved version of this model are presented. 20 refs., 12 figs.

25453 (INP—1268/PL, pp 269-298) **Signature splitting phenomena and the triaxial cranked shell model.** May, F.R. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The interplay of single particle (spin alignment) and shape (triaxiality) degrees of freedom are studied in terms of independent quasiparticles moving in a rotating triaxial potential. It turns out that a system of few aligned quasiparticles coupled to a superfluid γ-soft core seems to be the proper candidate for studying effects of a triaxial rotor at angular frequencies ranging from about 200 to 400 keV. Triaxial shapes are predicted to occur within given angular frequency and Fermi energy intervals as a result of increasing angular frequency and excitations of high-j quasiparticles. Emphasis is given to the γ-driving tendencies of high-j quasiparticle orbits and the effect of signature inversion which is demonstrated to probe the triaxiality parameter γ. 19 refs., 2 tabs., 13 figs.

25454 (INP—1268/PL, pp 371-382) **Boson-fermion approximation and the effects of pairing degrees of freedom in odd-A transitional nuclei.** Doenau, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The proposed Boson Fermion Coupling Model (BFM) enables us to include the dynamical distortions of the pair field on the same level into the description of odd-mass transitional and deformed nuclei as it can be done for the spatial distortions of the nuclear average potential. Implications of this theory are traced. It is shown that the pair field is naturally split into terms of dynamical and kinematical character that cause a state-dependent pair gap and rotation-induced contributions, respectively, both attenuating the Coriolis force. 12 refs., 2 figs.

25455 (INP—1268/PL, pp 383-391) **On the nature of the octupole deformation of nuclei around radium.** Sobiczewski, A. (Warsaw Univ. (Poland). Wydzial Fizyki). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

For the region of nuclei around radium and thorium the states show an anomaly consisting in exceptionally low values of the energy < 200 KeV what suggests a presence of the octupole deformation in the ground state shape of these nuclei. It is studied whether these suggestions find a support in theoretical calculations of the potential energy of nuclei and what kind of indications on the nature of the octupole deformation and its vibration can be obtained from these calculations. 19 refs., 3 figs.

25456 (INP—1268/PL, pp 408-412) **Comment on the microscopic calculation for the collective motion.** Pomorski, K.; Zajac, K.; Nerlo-Pomorska, B.; Rohozinski, S.G. (Uniwersytet Mikolaja Kopernika, Torun (Poland). Inst. Chemii; Warsaw Univ. (Poland). Inst. Fizyki Teoretycznej). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The comments on the microscopic calculations based on the cranking approximation for the nuclear collective motion are presented. Such a microscopic picture was applied to the nuclear rotation and to the quadrupole vibrations of the deformed nuclei. 9 refs., 3 figs. (M.F.W.).

25457 (INP—1268/PL, pp 413-416) **Level densities at high spins on Hartree-Fock-Bogoliubov basis.** Baran, A. (Uniwersytet Mikolaja Kopernika, Torun (Poland). Inst. Chemii). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

In fission reactions and deep inelastic processes states of large angular momentum are produced which deexcite themselves by emission of photons. The part of a gamma spectrum corresponding to high transition energies (E>2 MeV) reveals its statistical origin by a nearly exponential dependence on the excitation energy. A reason for this is an exponential dependence of level densities entering the process. At low energies one observes some humped structure in the gamma deexcitation spectrum and in a side feeding pattern. There are two bumps entering the probability of the side feeding vs angular momentum. I try to explain this kind of behaviour using a "closed" model for calculating level densities and consisting of a realistic interaction. The model for treating fermions is a Hartree-Fock-Bogoliubov procedure. The outcoming single quasiparticle energies together with wave functions give a good basis for calculating both level densities and matrix elements of transition operators entering the calculations of gamma spectra. 7 refs., 2 figs.

25458 (INP—1268/PL, pp 422-428) **Octupole shapes in nuclei, and some rotational consequences thereof.** Nazarewicz, W.; Olanders, P.; Ragnarsson, I.; Dudek, J.; Leander, G.A. (Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics; Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; UNISOR, Oak Ridge, TN (USA)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Octupole deformation explains the absence of a backbend in /sup 222/Th and is expected to manifest itself in odd-A neighbouring nuclei by a relatively small alignment in the yrast band (<j/sub x/>α3-4) and an even smaller alignment in all the side bands (<j/sub x/>α1-2). The octupole deformation could be stabilized at high spin by an inrcease of the collective moment of inertia. It can therefore happen that nuclei that are soft towards octupole deformation, but without stable octupole minimum, can move into the B/sub 3/not =0 area with inreasing rotational frequency. 6 refs., 3 figs., 1 tab.

25459 (INP—1268/PL, pp 429-434) **Some high-spin aspects of octupole shape in atomic nuclei.** Nazarewicz, W. (Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The experimental high-spin data for the sequence of thorium isotopes are presented. The rotational frequencies for the negative and positive parity bands at the same value of angular momentum were calculated. The potential energy surface for /sup 220/Ra is shown. The collective rotational excitations enhance and stabilize octupole as well as quadrupole deformations in this nucleus. The octupole mixing between positive and negative parity orbitals which influences the value of the yrast-yrare interaction and the value of the crossing frequency is illustrated. 9 refs., 4 figs. (A.S.).

25460 (INP—1268/PL, pp 435-437) **Negative parity levels of /sup 4/He using the hyperspherical harmonics method.** Arribas, E.; Navarro, J. (Department of Theoretical Physics, Faculty of Physical Sciences, Burjasot-Valencia (Spain)). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The hyperspherical harmonics method being a straightforward generalization of the treatment of single particle movement into a tridimensional space using spherical coordinates, in which the wave function is expanded over the spherical harmonics, is applied for a description of the negative parity levels of /sup 4/He. 4 refs. (A.S.).

25461 (INP—1268/PL, pp 444-446) **Dynamical effects on multipole moments.** Rozmej, P. (Uniwersytet Marii Curie-Sklodowskiej, Lublin (Poland). Inst. Fizyki). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

The influence of the zero-point quadrupole-hexadecapole vibrations on multipole moments of the deformed nuclei is investigated. The results of calculations for /sup 234/, /sup 236/, /sup 238/U are presented and compared with experimental data. 7 refs., 1 fig. (M.F.W.).

25462 (INP—1268/PL, pp 438-440) **Fokker-Planck equation and kinetic energy, mass and charge equilibration in fission.** Pomorski, K.; Mirski, E. (Uniwersytet Mikolaja Kopernika, Torun (Poland). Inst. Chemii). Sep 1984. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88701632/JAW. (CONF-8404157—).

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Different methods of solving the Fokker-Planck equation are shortly presented. This equation is applied to the case of spontaneous fission. 4 refs., 2 figs. (L.I.).

25463 **(IPNO-TH—87-50) Stretched harmonic oscillator. A test of semiclassical approximations.** Casas, M.; Martorell, J.; Krivine, H. (Les Illes Balears Univ., Palma de Mallorca (ES); Barcelona Univ. (ES). Facultad de Ciencas). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jun 1987. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752579/JAW.

We test the validity of semiclassical approximations (WKB, Miller and Good) in phase space in the one-dimensional case of independent particles confined by a stretched harmonic oscillator potential. This potential provides an illustrative example for many properties of atomic nuclei related to the saturation property of nuclear forces, while keeping the same mathematical simplicity as the usual harmonic oscillator.

25464 **(ISN—87-68) Proton-induced spallation reactions between 200 MeV and 20 GeV.** Cole, A.J.; Cherkaoui-Tadili, R. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jul 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752188/JAW.

Proton induced spallation reactions are studied in the energy region from 200 MeV to 20 GeV. An analytical expression is derived for the production cross-sections of target residues in which the incident proton energy dependence of the cross-sections is described by variation of a single parameter. Rather good agreement is obtained with experiment when reasonable physical assumptions for the variation of this parameter are made.

25465 **Low energy E0 transitions in odd-mass nuclei of the neutron deficient 180<A<200 region.** Zganjar, E.F.; Kortelahti, M.O.; Wood, J.L.; Papanicolopulos, C.D. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge, LA 70803, USA). *AIP (American Institute of Physics) Conference Proceedings;* **164**: No. 1, 313-323(10 Dec 1987). (CONF-870970—).

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

The region of neutron-deficient nuclei near Z = 82 and N = 104 provides the most extensive example of low-energy shape coexistence anywhere on the mass surface. It is shown that E0 and E0 admixed transitions may be used as a fingerprint to identify shape coexistence in odd-mass nuclei. It is also shwon that all the known cases where equally low-lying O^+ states occur in neighboring even-even nuclei. A discussion of these and other relevant data as well as suggestions for new studies which may help to clarify, and more importantly, quantify the connection between E0 transitions and shape coexistence are presented.

25466 **Light exotics.** Seth, K.K. (Northwestern University, Evanston, IL 60201, USA). *AIP (American Institute of Physics) Conference Proceedings;* **164**: No. 1, 324-333(10 Dec 1987). (CONF-870970—).

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

A discussion of the nuclear structure of light exotic nuclei (hydrogen and helium isotopes) is presented. Results from light ion transfer reactions and pion breakup and charge exchange reactions are used in this discussion (AIP)

25467 **Microcanonical simulation of nuclear disassembly.** Koonin, S.E.; Randrup, J. (California Inst. of Tech., Pasadena (USA). W.K. Kellogg Radiation Lab.; Lawrence Berkeley Lab., CA (USA). Nuclear Science Div.). *Nuclear Physics [Section] A;* **474**: No. 1, 173-192(16 Nov 1987).

Also published as report LBL--21165; CONF--860270-8.

We formulate a model for the disassembly of a highly excited finite nuclear source into interacting nuclear fragments. Monte Carlo sampling of the exact microcanonical and canonical ensemble provides many-fragment configurations at the effective freeze-out stage. The effect of including the interaction between the fragments

is significant and an elaboration of the model that allows for a nucleon vapor suggests the existence of a first-order phase transition.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 25394

25468 (EIR—636) JEF/EFF based nuclear data libraries. Vontobel, P.; Pelloni, S. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Dec 1987. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701797/JAW.

Using the NJOY nuclear data processing system, four multigroup neutron data libraries were generated based on the European data files JEF-1 and EFF-1. These cross section libraries can be read into various transport codes such as WIMS, ONEDANT, TWODANT etc., or into the integral transport theory code MICROX-2. For the neutron analysis of gas-cooled or water moderated thermal reactor systems (including high converter PWRs) a 70-group WIMS-BOXER and a 193-group GA-MICROX structured library were generated. Moreover a general purpose fine group library in 308 groups is provided for the analysis of thermal as well as fast reactor systems. Finally a coupled 175 neutron- 42 photon-group library in Vitamin-J structure was created for the analysis of shielding problems and fusion blanket design. The content and the parameters taken into account for each of those libraries are given in this report. (author) 33 refs., 6 figs., 9 tabs.

25469 (Juel—2130) Monte Carlo modelling and comparison with experiment of the nuclide production in thick stony targets isotropically irradiated with 600 MeV protons. Aylmer, D.; Herzog, G.F.; Kruse, T.H.; Begemann, F.; Weber, H.; Cloth, P.; Filges, D.; Dragovitsch, P.; Herpers, U.; Peiffer, F. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Physics; Max-Planck-Institut fuer Chemie (Otto-Hahn-Institut), Mainz (Germany, F.R.); Pennsylvania Univ., Philadelphia (USA). Dept. of Physics; Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Kristallographie und Petrographie; Trieste Univ. (Italy). Ist. di Fisica). May 1987. 266p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88752258/JAW.

Depth profiles for the production of stable and radioactive nuclides have been measured for a large variety of target elements in three thick spherical stony targets with radii of 5, 15 and 26 cm isotropically irradiated with 600 MeV protons at the CERN synchrocyclotron. These irradiation experiments (CERN SC96) were intended to simulate the irradiation of meteoroids by galactic cosmic ray protons. In order to combine this experimental approach with a theoretical one the intra- and internuclear cascades were calculated using Monte Carlo techniques via the high energy transport code HET/KFA 1. Together with transport calculations for low energy neutrons by the MORSE-CG code the depth dependent spectra of primary and secondary protons and of secondary neutrons were derived. On the basis of these spectra and a set of evaluated experimental excitation functions for p-induced reactions and of theoretical ones for n-induced reactions, calculated by the code ALICE LIVERMORE 82, theoretical depth profiles for the production of stable and radioactive nuclides in the three thick targets were calculated. This report is a comprehensive survey on all those target/product combination for which both experimental and theoretical data are available. It provides the basis for a detailed discussion of the various production modes of residual nuclides and on the depth and size dependence of their production rates in thick stony targets, serving as a simulation of the galactic cosmic ray irradiation of meteoroids in space. On the other hand the comparison of the experimental and theoretical depth profiles validates the high energy transport calculations, making them a promissing tool for further model calculations of the interactions of cosmic rays with matter.

25470 Inelastic cross sections and charge states for B, C, N, and O ions moving in metals. Sols, F.; Flores, F. (Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, Tennessee 37831). *Physical Review [Section] A: General Physics;* 37: No. 5, 1469-1475(1 Mar 1988).

We calculate the cross sections associated with the electronic capture and loss of B, C, N, and O ions moving in a solid target with velocities $v \sim Zv_0$ (where v_0 is the Bohr velocity). Three mechanisms are considered: Auger processes, whereby an electron is captured or lost creating an electronic excitation in the solid; resonant processes, coherently induced by the target crystal potential; and direct capture of electrons from the target inner shells. Atomiclike processes control the charge transfer for the velocities vapprox. $> Zv_0$. The distribution of charge states has been calculated as a function of the ion velocity. Good agreement is found with the available experimental data.

6550 Medical Physics

REFER ALSO TO CITATION(S) 24116, 24117, 25149, 25670

25471 (EHD—83-87) Bioassay guideline 2: guidelines for tritium bioassay. (Department of National Health and Welfare, Ottawa, Ontario (Canada). Health Protection Branch). 1983. 68p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701796/JAW.

Report of the Working Group on Bioassay and In Vivo Monitoring Criteria to the Federal-Provincial Advisory Committee on Environmental and Occupational Health. French version included as DHM--83-87.

This guideline is one of a series under preparation by the Federal-Provincial Working Group on Bioassay and In Vivo Monitoring Criteria. In this report tritium compounds have been grouped into four categories for the purpose of calculating Annual Limits on Intake and Investigation Levels: tritium gas, tritiated water, tritium-labelled compounds and nucleic acid precursors.

25472 (INFO—0140) Exposure of hospital workers to xenon-133. Deschamps, Michel. (Radioprotection Inc.). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Nov 1984. 68p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701921/JAW.

During procedures for pulmonary ventilation studies on patients in hospitals, xenon-133 may escape in ambiant air. Measurements of air concentrations were required to permit an evaluation of exposure to workers in hospitals. Two complementary methods of in situ measurements of air concentrations were employed: a commercial air monitor and blood sampling evacuated vials. Personal dosimeters (TLD) were exposed simultaneously with the commercial air monitor, results were compared. This report presents the results of measured air concentration during patient exams. Important leakage of xenon-133 were measured but the workers received less than the maximum permissible dose. Personal dosimeters do not permit an accurate evaluation of skin dose from xenon-133, measured air concentration is required. Procedures are given to help minimize leakage and personnel exposures.

25473 (JAERI-M—87-147) Health physics in JAERI. No.29. April 1, 1986 - March 31, 1987. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 275p. (In Japanese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88752338/JAW.

There were no occupational exposure exceeding the maximum permissible dose and no release of radioactive gaseous and liquid waste beyond the release limit specified according to the regulations. In the environment there were observed no abnormal radioactivity except fallout due to the Chernobyl accident. Technology developments were made as in the previous years for improving the techniques and methods in monitoring of individuals, facilities and environment, radiation measurement instrumentation and also in waste management and decontamination. The following works were made in the researches of radiation dosimetry, body radioactivity, airborne radioactivity and estimation of radiation dose due to low level waste disposal. For radiation dosimetry: evaluation of β-

ray dose equivalent rates, activity measurement of large area γ-ray plane source, assessment of U.S. occupational exposure, application of HLN distribution to assessing average internal exposure of workers, and property of statistics of HLN distribution. For body radioactivity: realistic chest phantom with artificial rib cage for an assessment of Pu in lung, and radiosensitivity of chromosomes of rabbit lymphocytes. For airborne radioactivity and waste disposal: sheltering effect of houses for radioactive effluent, physicochemical species of airborne iodine-131 in Japan from Chernobyl, deposition velocities of iodine-131 due to the Chernobyl accident, tritium oxide permeability of membranes in protective appliances, calculation of doses from the pathway of groundwater migration for shallow land disposal of radioactive waste, and safety demonstration tests of rational disposal of very low-level radioactive solid waste.

25474 **(JAERI-M—87-172) Table of committed effective dose equivalents according to the ICRP Publication 30.** Kawai, Katsuo; Tachibana, Haruo; Hattori, Takamitsu; Suga, Shinichi. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 86p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88752342/JAW.

The International Commission on Radiological Protection (ICRP) recommended the limits for intakes of radionuclides by workers in its publication 30. To provide an advantage for dose assessment in radiation protection, this report presents the tabulation of the committed effective dose equivalents per unit intake and the committed dose equivalents per unit intake to a particular organ and tissue to which the non-stochastic limit applies for the radionuclides either included in ICRP Publication 30 or selected from their radiological significance. It also contains the tabulation of the effective dose equivalent rates to workers submerged in unit concentration of radioactive gases.

25475 (LBL—22300, pp 40-42) **Effects of slice selection and diffusion on T_2 measurement.** Wong, S.T.; Roos, M.S. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

Proton NMR imaging is a sensitive indicator of brain pathology that is being used at LBL to study radiation effects and aging human subjects. In the nuclear magnetic resonance (NMR) studies we examine the distributions of spin-spin relaxation (T_2) and spin-lattice (T_1) relaxation time constants in different regions of the brain by a multi-echo spinwarp imaging sequence using selective excitation and selective refocusing rf pulses. Unfortunately, estimates of these parameters from images are subject to systematic errors resulting from the imaging technique. In addition it is important to distinguish among the various physical processes that contribute to the observed T_2. We conducted an experimental study that confirms theoretical results suggesting that the use of selective refocusing pulses causes bias in such estimate of T_2. This apparent change in T_2 has been previously attributed to diffusion. With normal imaging gradient strength and duration, classical NMR diffusion theory suggests that suppression of signal due to diffusion during slice selection is insignificant. We verified that diffusion effects are small and that the apparent change in T_2 is mainly due to resonance offset effects. In addition, we have demonstrated a method to correct for the T_2 bias. 1 ref., 2 figs., 1 tab.

25476 (LBL—22300, pp 105-106) **Comparison of dose localization properties of carbon and proton beams.** Blakely, E.; Chu, W.T.; Ludewigt, B.A.; Phillips, M.H.; Tobias, C.A. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

New charged particle accelerators for radiotherapy applications are currently being discussed and designed. Thus, the question of which particle beams are optimal for specific clinical applications needs to be investigated. Dose localization plays an important role in treatment. Theoretical considerations based on multiple scattering theories indicate that carbon beams have better dose localization properties than proton beams because heavier charged particles scatter less than lighter ones. We have measured dose distributions produced by narrowly collimated carbon and proton beams using an identical experimental setup thus allowing a direct comparison. 3 figs.

25477 (LBL—22300, pp 157-161) **Radiotherapy physics.** Collier, J.M.; Henderson. S.D.; Pitluck, S.; Petti, P.; Kessler, M.; Baken, K. Apr 1987. NTIS, PC A13/MF A01. Order Number DE87009280/JAW.

In Biology and Medicine Division: Annual report 1986.

During the past year three new elements have been introduced into the beam line at the Bevatron to improve patient treatment. These are the wobbler magnets, the bar-ridged filters, and the binary absorber. The wobbler consists of a pair of orthogonal dipole magnets that sweep the beam in concentric circles up to 30 cm in diameter. This device replaces the lead scattering-foil system for spreading the beam laterally. This change allows the reduction of the beam energy from 670 MeV/amu to 585 MeV/amu while maintaining the same depth of penetration in the patient. The binary absorber is a set of copper and aluminium plates of binary increments in thickness. Like the variable thickness water column, which it replaces, the binary range absorber sets the residual range of the particles as they enter the final patient compensating filtering. 6 refs., 3 figs., 1 tab.

25478 **(RERF-TR—6-86) Hospital and clinic survey estimates of medical X-ray exposure in Hiroshima and Nagasaki, 2. Technical exposure factors.** Antoku, Shigetoshi; Hoshi, Masaharu; Sawada, Shozo; Russell, W.J. (Radiation Effects Research Foundation, Hiroshima (Japan)). Jul 1987. 15p. (In Japanese and English). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752322/JAW.

The technical factors used during radiological examinations performed in Hiroshima and Nagasaki medical institutions were analyzed. The most frequently performed examination was chest radiography, followed by upper GI series. More than half the radiographic exposures were from upper GI series due to the many spot films made during fluoroscopy. Comparison of the present survey results with those of a previous one showed that relatively high kVp, low mAs and mA, and smaller field sizes are now more widely used. Though there have been decreased in fluoroscopy times and tube currents over the past 10 years, the numbers of spot films used have increased. Based on these technical factors, tables of organ doses from fluoroscopic examinations were compiled.

25479 **Spectral emissivity of tungsten: analytic expressions for the 340-nm to 2.6-μm spectral region.** Pon, R.M.; Hessler, J.P. (Argonne National Lab., IL). *Applied Optics;* **23**: No. 7, 975-976(1 Apr 1984). Contract W-31-109-ENG-38.

To correct emission spectra a standard radiance source is often used to determine the spectral responsivity of the detection system. In the near-UV, visible, and near-IR spectral regions the most common radiance standard is a tungsten strip lamp calibrated by a standards laboratory. For day-to-day experiments where slightly less accuracy is acceptable, a less expensive uncalibrated lamp is useful. In this case, the radiant temperature T/sub r/ of the lamp is measured with an optical pyrometer, generally at a single wavelength such as 650 nm, and the source spectral radiance L(λ) is calculated from L(λ) = tau(λ)epsilon(λ,T)L/sub B/(λ,T). The transmittance of the source is tau(λ), the spectral emissivity is epsilon(λ,T), and L/sub B/(λ,T) is the spectral distribution of blackbody radiation, Planck's radiation law. To obtain the true temperature T, Wien's approximation is employed. To conveniently calibrate a system, especially one which utilizes a microcomputer, it is advantageous to have analytic expressions for the spectral emissivity of tungsten. Although Larrabee has published such expressions, they are limited to the 450-800-nm spectral region. To obtain analytic expressions from 340 nm to 2.6 μm they have used the measurements of DeVos. Although DeVos's results differ by 2% from those of Larrabee, this difference is assumed to be acceptable.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 24620, 24621, 24631, 24668, 24691, 24911

25480 (CEA-CONF—9214) Use of extinction corrections in neutron diffraction experiments. Delapalme, A. (Laboratoire Leon Brillouin, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1987. 10p. (CONF-8708218—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752225/JAW.

From Symposium on accuracy in structure factor measurements; Victoria, Australia (23 Aug 1987).

Extinction can be treated through various models originating in either kinematical (intensity coupling) or dynamical (wave coupling) theories. For most crystals the situation is intermediate between these two extreme cases and extinction models are necessary to obtain precise Fourier components (structure factors) and the electronic and magnetic distribution in molecules and crystals. New models reveal new parameters and new effects of their role in the Extinction phenomena, but the phenomenological aspect of the solutions shows the difficulty to describe adequately what happens in real crystals.

25481 (DOE/ER/40093—T1-Vol.5) Physics through the 1990s: Condensed-matter physics. (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 321p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE88006394/JAW.

In this survey of condensed-matter physics we describe the current status of the field, present some of the significant discoveries and developments in it since the early 1970s, and indicate some areas in which we expect that important discoveries will be made in the next decade. We also describe the resources that will be required to produce these discoveries. This volume is organized as follows. The first part is devoted to a discussion of the importance of condensed-matter physics; to brief descriptions of several of the most significant discoveries and advances in condensed-matter physics made in the 1970s and early 1980s, and of areas that appear to provide particularly exciting research opportunities in the next decade; and to a presentation of the support needs of condensed-matter physicists in the next decade and of recommendations aimed at their provision. Next, the subfields of condensed-matter physics are reviewed in detail. The volume concludes with several appendixes in which new materials, new experimental techniques, and the National Facilities are reviewed.

25482 (DOE/ER/45059—2) Multilayer film growth on silver using surface plasmon resonance: Closeout report for period April 1, 1981-September 30, 1986. Bretz, M. (Michigan Univ., Ann Arbor (USA). Dept. of Physics). 30 Dec 1987. Contract FG02-84ER45059. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006546/JAW.

This project measured the dynamic film growth properties of xenon multilayers adsorbed on vapor deposited silver between 67K and 85K. The measurements required a high quality spectrometer table, a bakeable high vacuum chamber, a cold tip closed cycle refrigerator and a residual gas analyzer in addition to the electronics, servo system, optics and computer data acquisition equipment. The experimental sensitivity was adequate to resolve film thickness changes as small as .05 layers and the corresponding surface roughness effects due to these changes. We found that below about 75K xenon on silver(111) grows as quenched films and unless the deposition rate is extremely slow, they do not anneal appreciably. At higher temperatures the xenon atoms migrate laterally to regions of higher adsorption potential forming xenon islands. An activation energy for this process was measured as 1770K and the island formation was determined to be proportional to the deposition rate. In addition to a thesis, three APS talks were given on this experiment and a PRL has been submitted. 4 refs., 3 figs.

25483 (IC—86/287) On linear relationship between shock velocity and particle velocity. Dandache, H. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1986. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701827/JAW.

We attempt to derive the linear relationship between shock velocity U/sub s/ and particle velocity U/sub p/ from thermodynamic considerations, taking into account an ideal gas equation of state and a Mie-Grueneisen equation of state for solids. 23 refs.

25484 (IC—87/124) Lattice theory of fracture of solids with layered structure. Tian Decheng; Xu Yinhua; Li Guoming; Guan Weiho. (International Centre for Theoretical Physics, Trieste (Italy); Wuhan Univ., (China). Physics Dept). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701867/JAW.

The lattice trapping effect of a crack in solids with layered structure has been studied with Thomson's chain model. It is shown that the difference in physico-mechanical properties between different atomic planes has significant influence upon this effect and the stress range for stability of a crack can be enhanced by increasing the difference. This perhaps provides a way for the lattice trapping effect to be made observable by appropriately synthesizing solids with superlattice of special design. (author). 4 refs, 9 figs, 1 tab.

25485 (IC—87/148) On the dynamic local field factor of a uniform electron liquid. Mukhopadhyay, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701890/JAW.

We consider here the dynamic local field factor G(q-tilde,ω) of a uniform interacting electron liquid, and describe approximations which yield a G having a static part analogous to that of the Vashishta-Singwi-theory, and a dynamic part having a structure similar to that obtainable from the mode-coupling theory of the Memory-function approach. In particular, we present the q -> 0 limit of the imaginary part of G(q-tilde,ω) and obtain the ω/sup -3/ 2/ dependence at large ω, in agreement with the diagramatic calculations. (author). 22 refs.

25486 (IC—87/154) Towards a renormalization-group theory of spin glasses. Dotsenko, V.S. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701896/JAW.

The renormalization-group scheme for the thermodynamic theory of metastable states in spin-glasses is proposed. Based on the hierarchical organization of metastable states in spin-glasses it is possible to calculate an effective spin-spin interaction with increasing scale in a phase space. Below the phase transition point the system is effectively "trapped" in a finite region of the phase space which corresponds to one of the ancestor states of the hierarchical tree. (author). 5 refs, 2 figs.

25487 (IC—87/159) Effect of structural relaxation of metallic glasses on positron annihilation parameters. Tian Decheng; Xiong Liangyue; Tang Zhongxun; Xu Yinhua. (International Centre for Theoretical Physics, Trieste (Italy); Wuhan Univ. (China). Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701901/JAW.

The results of a comparative study of positron lifetime and a Doppler broadening line-shape parameter for two metallic glasses are presented. The change of lifetime tau-bar and the S-parameter for these two metallic glasses are shown to have a common feature, i.e. at the initial stage of structural relaxation, tau-bar presents a peak-form as a function of annealing time or temperature while the S-parameter decreases monotonically. A possible mechanism is proposed for explaining the peak-form of tau-bar which has been observed in many metallic glasses; the initial rise and the following decrease of tau-bar are attributed to the homogenization of defects taking place during the structural relaxation. The monotonic behaviour of the S-parameter seems to indicate that the annihilation of positrons in free state with the high momentum core electrons is negligible. (author). 8 refs, 2 figs.

25488 (JAERI-M—87-166) Progress report on JAERI - ORNL cooperative neutron scattering research. April 1, 1985 - March 31, 1987. Funahashi, Satoru (ed.). (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 112p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752329/JAW.

Research activities performed by using the Wide Angle Neutron Diffractometer(WAND) installed to the High Flux Isotope Reactor(HFIR) of the Oak Ridge National Laboratory(ORNL) during the period of JFY1985 to 1986 under the US-Japan Cooperative Neutron Scattering Research Program are summarized. JFY1985 was the year of the full-fledged cooperative research. Studies of phase transition kinetics by making use of the rapid temperature change auxiliary equipment and the two-dimensional neutron diffraction studies of single crystals were carried out before the unexpected shutdown of HFIR at November 1986. Two reports related with instrumentation and eleven reports describing the neutron scattering experiments are contained in this volume.

25489 (KU-HCOE-FL2-R—87-5) Melting and misalignment of solid crystalline krypton inclusions in aluminium. Andersen, H.H.; Johansen, A.; Johnson, E.; Sarholt-Kristensen, L.; Surganov, V.; Bohr, J. (Copenhagen Univ. (Denmark). Fysisk Lab. 2; Risoe National Lab., Roskilde (Denmark). Physics Dept.). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.). 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752687/JAW.

Ion implantation induced crystalline krypton inclusions in aluminium, epitaxially aligned with the matrix, have been investigated with X-ray diffraction and Rutherford backscattering, channeling analysis. The data show a dual size distribution of the krypton bubbles. In samples annealed up to 620 K and subsequently cooled, the larger bubbles melt in a pressure broadened transition at 114-118 K. The smaller bubbles remain solid upon heating but, as a result of a roughening transition on the aluminium facets of the cavities, the Kr crystallites gradually loose their epitaxial alignment.

25490 Summary abstract: H^- production from partially cesiated surfaces in the presence of a hydrogen plasma. Wada, M.; Pyle, R.V.; Stearns, J.W. (Lawrence Berkeley Lab., CA). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* 2: No. 2, 676-677(Apr-Jun 1984). Contract AC03-76SF00098.

High H^- yields from surfaces immersed in cesiated hydrogen plasmas have been attributed to the likely low work function of the partially cesiated surface and studies have, since, related the two. A large source employing a magnetic bucket geometry with a large curved converter surface focused on a single slit extractor is presently being studied at LBL. In order to understand the relationships among the Cs coverage, the high energy (back-scattered) and low energy (desorbed) H^- beams and the angular and energy distributions of the beams, they have constructed a small version of the LBL source in which the work function of the converter, which is immersed in the plasma ($n < 10^{11}/cm^3$), can be measured by photoemission while the other parameters are varied. In addition, the converter can be rotated and the H^- beam collimated and analyzed to give a complete energy and angular spectrum.

6561 Superconductivity

REFER ALSO TO CITATION(S) 24614, 24673, 24674, 24676, 24679, 24685

25491 (DOE/ER/45113—4) Magnetic impurities in superconductors: Performance report, September 1, 1987-August 31, 1988. Ruvalds, J. (Virginia Univ., Charlottesville (USA). Dept. of Physics). 1988. Contract FG05-84ER45113. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006917/JAW.

This paper documents investigations into the physics of superconductivity, especially cuprate materials. Research of plasmon mechanisms indicates the two-dimensional structure of Cu-O planes favors certain aspects of plasmon exchange as a source of electron pairing. This result suggests other alloys which may be high Tc superconductors. (JDH)

25492 (IC—87/125) Phenomenological approach to high T/sub c/ oxide superconductors. Chela-Flores, J.; Das, M.P.; Saif, A.G. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701868/JAW.

Oxide superconductors are described in terms of macroscopic wave functions PSI and PHI corresponding, respectively, to electron pairs of the superconducting and insulating states. In terms of the total free energy of the system, including the effect of interaction, we discuss the electrodynamic responses of the oxide superconductors in relation with the experiments to data. (author). 10 refs.

25493 (LA-UR—88-366) Crystal field interaction and magnetic order in GdBa/sub 2/Cu/sub 3/O/sub 7/. Causa, M.T.; Fainstein, C.; Nieva, G.; Sanchez, R.; Steren, L.B.; Tovar, M.; Zysler, R.; Vier, D.C.; Schultz, S.; Oseroff, S.B. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche; Universidad Nacional de Cuyo, Mendoza (Argentina). Inst. Balseiro; California Univ., San Diego, La Jolla (USA); San Diego State Univ., CA (USA); Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880158—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006472/JAW.

From 9. winter meeting on low temperature physics high-Tc superconductors; Tequesquitengo, Mexico (10 Jan 1988).

We report experimental data on the crystal field interaction of Gd ions with their environment in Gd/sub x/Eu/1-x/$Ba_2Cu_3O_7$. The ESR spectrum and a Schotiky anomaly in the specific heat of dilute samples indicate the existence of a crystal field splitting of the ^{8}S/sub 7/2/ ground state of the Gd^{3+} ions of about 1.5K. Since the single ion energies involved are of the same order of magnitude as the energies associated with the magnetic ordering of the Gd moments in $GdBa_2Cu_3O_7$ (T/sub N/ = 2.24K) we analyze the effects of the crystal field interaction on the magnetic transition. 10 refs., 4 figs.

25494 Sulfur-based synthetic metal superconductors. Williams, J.M.; Beno, M.A.; Carlson, K.D.; Emge, T.J.; Geiser, U.; Schultz, A.J.; Wang, H.H.; Whangbo, M.-H. (Argonne National Lab., IL, USA; North Carolina State Univ., Raleigh, USA). pp 70-81 of Fine chemicals for the electronics industry: the proceedings of a symposium organised by the Fine Chemicals and Medicinals Group of the Industrial Division of the Royal Society of Chemistry, Bath, UK, 2-4 April 1986. Bamfield, P. (ed.). London, England; Royal Society of Chemistry (1986). (CONF-8604192—). Contract W-31-109-ENG-38.

From Conference on fine chemicals for the electronics industry; London, UK (2 Apr 1986).

A summary is given of the current status and findings regarding BED-TTF (ET) based synthetic metal superconductors; in particular: β-(ET)/sub 2/I/sub 3/ (T/sub c/=1.4K), β-(ET)/sub 2/IBr/sub 2/ (T/sub c/=2.8K) and β-(ET)/sub 2/AuI/sub 2/ (Tsub(c)=5K). The unique crystal packing features of these layer-like systems is described and the role of the linear triatomic halide containing anions is explored. Electronic band structure calculations are in agreement with the 2D nature of the β-(ET)/sub 2/X structure. These theoretical studies suggest that the superconducting critical temperatures of β-(ET)/sub 2/X type materials might be increased significantly above presently observed values by the use of different linear anions, or entirely new donor molecule anion combinations.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 25059, 25272

25495 (FNAL/Pub—88/18-A) Einstein metrics and Brans-Dicke superfields. Marques, S. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jan 1988. Contract AC02-76CH03000. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006992/JAW.

It is obtained here a space conformal to the Einstein space-time, making the transition from an internal bosonic space, constructed with the Majorana constant spinors in the Majorana representation, to a bosonic "superspace," through the use of Einstein vierbeins. These spaces are related to a Grassmann space constructed with the Majorana spinors referred to above, where the "metric" is a function of internal bosonic coordinates. The conformal function is a scale factor in the zone of gravitational radiation. A conformal function dependent on space-time coordinates can be constructed in that region when we introduce Majorana spinors which are functions of those coordinates. With this we obtain a scalar field of Brans-Dicke type. 11 refs.

25496 **(IC—86/306) Hamiltonian with linear kinetic energy for systems of many bodies.** Cook, A.H. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1986. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701828/JAW.

A proper quantum mechanical Hamiltonian should have a single time variable and a single energy but a corresponding Lorentz invariant expression for the rest energy has so far not been found. In this paper, an approximately Lorentz invariant form incorporating the potential energy of interactions between particles is put into an equivalent linear form by the use of Clifford algebra. Some of the properties of the resulting many-body Hamiltonian are set out and some applications to molecular structure are indicated. (author). 18 refs.

25497 **(IC—86/317) Accurate solution of parabolic equations by expansion in ultraspherical polynomials.** Doha, E.H. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1986. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701829/JAW.

An ultraspherical expansion technique is applied to obtain numerically the solution of the third boundary value problem for linear parabolic partial differential equation in one-space variable. The differential equation with its boundary and initial conditions is reduced to a system of ordinary differential equations for the coefficients of the expansion. This system may be solved analytically or numerically in a step-by-step manner. The method in its present form may be considered as a generalization of that of Dew and Scraton. The extension of the method to the polar-type equations is also considered. (author). 12 refs, 1 tab.

25498 **(IC—86/319) Supersymmetric extension of twistor formalism.** Lukierski, J. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701830/JAW.

The paper discusses the supersymmetric extension of twistor formalism for D=4. The multidimensional extensions of twistor formalism for D>4 are also briefly discussed. 68 refs.

25499 **(IC—86/328) Theory of relativity and super-light-speeds-I: Kinematical part.** Cao Shenglin. (International Centre for Theoretical Physics, Trieste (Italy)). May 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701832/JAW.

According to some local properties of Lorentz transformation, Einstein stated: "Velocities greater than that of light have no possibility of existence". He neglected to point out the applicable range of the special theory of relativity. In fact, it could only be applied to the sub-light-speed. This paper shows that if we think of the possibility of the existence of the super-light-speed and redescribe the special theory of relativity following Einstein's way, a new kinematical theory would be founded. The new theory would retain all kinematical meaning of the special theory of relativity when matters move with sub-light-speed and would give new content when matters move with super-light-speed. The paper also discusses the observation principle for the motions with the super-light-speed. (author). 2 refs, 1 fig.

25500 **(IC—86/336) Finitely many δ-interactions with supports on concentric spheres.** Shabani, J. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701834/JAW.

Using the theory of self-adjoint extensions of symmetric operators we give the precise mathematical definition of the quantum Hamiltonian describing a finite number of δ-interactions with supports on concentric spheres. We also derive its resolvent, describe its spectral properties and show how this Hamiltonian can be obtained as a norm resolvent limit of a family of local scaled short-range Hamiltonians. (author). 15 refs.

25501 **(IC—86/346) Finite element approximation to a model problem of transonic flow.** Tangmanee, S. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701835/JAW.

A model problem of transonic flow "the Tricomi equation" in Ω is contained in IR/sup 2/ bounded by the rectangular-curve boundary is posed in the form of symmetric positive differential equations. The finite element method is then applied. When the triangulation of Ω-bar is made of quadrilaterals and the approximation space is the Lagrange polynomial, we get the error estimates. 14 refs, 1 fig.

25502 **(IC—86/382) On type of entire functions of several complex variables.** Opoola, T. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701846/JAW.

It is known except possibly for z in a very thin set namely a set of Γ-capacity zero, that rho/sub f/=rho/sub F/ where rho/sub f/ is the order of entire function f(z) on is not contained in /sup n/ and rho/sub F/ is the order of its projective function F(w,z) on p/sup n-1/. The same property does not hold for the type of entire functions on is not contained in /sup n/ because of the dependence of the type of functions on the domain. In this paper we provide an analogue of this property for the type of entire functions on is not contained in /sup n/. (author). 4 refs.

25503 **(IC—86/383) Rates of convergence of Brezier net over triangles.** Feng Yuyu. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701847/JAW.

It is well known (Farin, 1979) that the sequence of Bezier nets f-circumflex/sub n/(x) associated with Bernstein-Bezier surface over a triangle converges to the surface uniformly as n goes to infinity. In this paper the precise rates of convergence are given. The pointwise convergence result and saturation theorem are presented. (author). 7 refs.

25504 **(IC—86/390) Nontrivial critical points for asymptotically quadratic function.** Li Shujie; Liu, J.Q. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701851/JAW.

In this paper we study the existence of some nontrivial critical points. As applications, we study the existence of nontrivial solutions of the Dirichlet problem for nonlinear elliptic partial differential equations and periodic boundary value problem for nonlinear ordinary differential equations. (author). 6 refs.

25505 **(IC—86/393) Canonical construction of differential operators intertwining representations of real semisimple Lie groups.** Dobrev, V.K. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1986. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701852/JAW.

Let G be a real linear connected semisimple Lie group. We present a canonical construction of the differential operators intertwining elementary (ident to generalized principal series) representations of G. The results are easily extended to real linear reductive Lie groups. (author). 20 refs.

25506 **(IC—86/395) Graphs with parallel mean curvature.** Costa Salavessa, I.M. da. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701854/JAW.

Let f:M -> N be a smooth map between two Riemannian manifolds (M,g) and (N,h). The graph of f, Γ/sub f/ = ((x,f(x)) : x ϵ M) is a submanifold of MxN. We prove that if (M,g) has Cheeger constant equal to zero, then, if Γ/sub f/ has parallel mean curvature, then actually Γ/sub f/ is a minimal submanifold of MxN. This extends a result of Heinz for M = chemical bondR/sup 2/, N = chemical bondR, and a result of Chern, and also of Flanders, for the case M = chemical bondR/sup n/, N = chemical bondR. (author). 8 refs.

25507 **(IC—86/398) Symmetries of a KdV-type equation.** Li Yishen; Baby, B.V. (Univ. of Science and Technology of China, Hefei (China). Dept. of Mathematics). (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1986. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701855/JAW.

The infinitely many commuting symmetries and recursion operator of a recently introduced KdV-type equation, u/sub t/ +βt/sup 2n+1/(u/sub xxx/-6uu/sub x/)+(n+1)/t(xu/sub x/)+2u)=0 is studied in this letter. It is found that this new equation has two types of symmetries which are generated by the same recursion operator. The Lie algebra that is associated with the two types of symmetries is also found. (author). 9 refs.

25508 **(IC—87/114) Path integration via Hamilton-Jacobi coordinates and applications to tunnelling.** Barut, A.O.; Duru, I.H. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701857/JAW.

The path integral for propagator is reduced to an ordinary integral in terms of the generator of a canonical transformation, and is evaluated exactly for potential barriers. (author). 3 refs.

25509 **(IC—87/115) On disentanglement of quantum wave functions: Answer to a comment on "Unified dynamics for microscopic and macroscopic systems".** Ghirardi, G.C.; Rimini, A.; Weber, T. (International Centre for Theoretical Physics, Trieste (Italy); Pavia Univ. (Italy). Dipartimento di Fisica Nucleare e Teorica; Trieste Univ. (Italy). Ist. di Fisica Teorica). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701858/JAW.

It is shown that the assumption of a stochastic localization process for the quantum wave function is essentially different from the suppression of coherence over macroscopic distances arising from the interaction with the environment and allows for a conceptually complete derivation of the classical behaviour of macroscopic bodies. (author). 4 refs.

25510 **(IC—87/117) Theory of pseudo-differential operators over C*-Algebras.** Mohammad, N. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701860/JAW.

In this article the behaviour of adjoints and composition of pseudo-differential operators in the framework of a C*-algebra is studied. It results that the class of pseudo-differential operators of order zero is a C*-algebra. 8 refs.

25511 **(IC—87/126) Sequential approach to Colombeau's theory of generalized functions.** Todorov, T.D. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701869/JAW.

J.F. Colombeau's generalized functions are constructed as equivalence classes of the elements of a specially chosen ultrapower of the class of the C/sup ∞/-functions. The elements of this ultrapower are considered as sequences of C/sup ∞/-functions, so in a sense, the sequential construction presented here refers to the original Colombeau theory just as, for example, the Mikusinski sequential approach to the distribution theory refers to the original Schwartz theory of distributions. The paper could be used as an elementary introduction to the Colombeau theory in which recently a solution was found to the problem of multiplication of Schwartz distributions. (author). Refs.

25512 **(IC—87/128) Dispersive water wave equations. A paradigm of Painleve conjecture.** Roy, S.; Chowdhury, A.R. (International Centre for Theoretical Physics, Trieste (Italy); Jadavpur Univ., Calcutta (India). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701871/JAW.

We have analysed the equation of dispersive water waves within the formalism of singular point analysis of Painleve conjecture. It is interesting to observe that the two different similarity reductions lead to apparently different looking ordinary differential equations with similar singularity structure. While one is a pure Painleve equation the other is not. On the other hand, a direct analysis of the PDE itself shows resonances at r = -1, 2, 3, 4 which contains those of the ODE. But if we adopt the exact procedure of Weiss et al. and try to truncate the expansion then it is seen that the set of equations obtained are not overdetermined. So it is not possible to derive the Lax pair via the Painleve analysis but a Backlund transformation can be written. But the number of arbitrary coefficients is seen to be in conformity with the Cauchy-Kowalevskya theorem. (author). 7 refs.

25513 **(IC—87/132) Exact solutions of the Dirac equation in spatially flat Robertson-Walker space-times.** Barut, A.O.; Duru, I.H. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701874/JAW.

Exact solutions of the Dirac equation (including neutrino case, m=0) for three models of expanding universes are given. Gordon decomposition of the current is discussed. (author). 10 refs.

25514 **(IC—87/141) Initial boundary value problems of nonlinear wave equations in an exterior domain.** Chen Yunmei. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701883/JAW.

In this paper, we investigate the existence and uniqueness of the global solutions to the initial boundary value problems of nonlinear wave equations in an exterior domain. When the space dimension n >= 3, the unique global solution of the above problem is obtained for small initial data, even if the nonlinear term is fully nonlinear and contains the unknown function itself. (author). 10 refs.

25515 **(IC—87/146) On the third Betti number of some compact homogeneous manifolds.** Azad, H. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701888/JAW.

We determine closed skew-symmetric covariant tensors of rank 3 on homogeneous spaces of compact simple Lie groups. (author). 6 refs.

25516 **(IC—87/147) Homogeneous affine bundles.** Azad, H. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701889/JAW.

Let G be a semi-simple linear algebraic group defined over an algebraically closed-field k. We describe the subgroups H of a parabolic P such that P/H is the affine line. (author). 4 refs.

25517 **(IC—87/157) Combining relativity and quantum mechanics: Schroedinger's interpretation of psi.** Barut, A.O. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701899/JAW.

The incongruence between quantum theory and relativity theory is traced to the probability interpretation of the former. The classical continium interpretation of psi removes the difficulty. How quantum properties of matter and light, and in particular the radiative problems, like spontaneous emission and Lamb shift, may be accounted in a first quantized Maxwell-Dirac system is discussed. (author). 17 refs.

25518 **(IC—87/162) Note on groups of semi-isomorphisms and isomorphisms associated with semi-linear and linear transformations.** Bhattarai, H.N. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701904/JAW.

Different groups of semi-linear and linear transformations of a vector space induce groups of collineations in the associated projective space. It is shown here how such groups give rise to different groups of semi-isomorphisms and isomorphisms in the more general case of Pasch geometric spaces. (author). 7 refs.

25519 **(KFKI—1987-63/B) Harmonic oscillator in the forceless mechanics of Hertz and in the Riemannian spacetime geometry.** Fueloep, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Oct 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701946/JAW.

The forceless mechanics of Hertz is a reformulation of the classical mechanics in a curved configuration space. The relationship between the forceless mechanics and the general relativity theory which uses curved Riemann spaces as well is investigated on the simple example of the harmonic oscillator. The mathematical similarities and differences and the different interpretations of similar formulas are discussed. Some formal constants of the Hertz mechanics have got concrete physical meanings in the general relativity. (D.Gy.).

25520 **(KU-HCOE-FL2-R—87-3) Thermodynamic geometry and the metrics of Weinhold and Gilmore.** Andresen, B.; Berry, R.S.; Gilmore, R.; Ihrig, E.; Salamon, P. (Copenhagen Univ. (Denmark). Fysisk Lab. 2; Chicago Univ., IL (USA). Dept. of Chemistry; Drexel Univ., Philadelphia, PA (USA). Dept. of Physics and Atmospheric Science; Arizona State Univ., Tempe (USA). Dept. of Mathematics; San Diego State Univ., CA (USA). Dept. of Mathematical Sciences). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Chicago Univ., IL (USA). Dept. of Chemistry; Drexel Univ., Philadelphia, PA (USA). Dept. of Physics and Atmospheric Science; Arizona State Univ., Tempe (USA). Dept. of Mathematics). 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752685/JAW.

The thermodynamic geometries of Gibbs, Weinhold, and Gilmore are compared and the benefits of each are pointed out along with the structures which must be abandoned in order to reap the benefits. When Weinhold's metric is used to measure distance in the equation of state surface, the traditional Gibbsian picture of equilibrium thermodynamics, based on convexity, must be abandoned. Gilmore's metric is compatible with standard Gibbsian thermodynamics. This metric measures distance in the potential surface of statistical mechanics rather than the equation of state surface of equilibrium thermodynamics.

25521 **(KU-HCOE-FL2-R—87-4) Inducing Weinhold's metric from Euclidean and Riemannian metrics.** Andresen, B.; Berry, R.S.; Ihrig, E.; Salamon, P. (Copenhagen Univ. (Denmark). Fysisk Lab. 2; Chicago Univ., IL (USA). Dept. of Chemistry; Arizona State Univ., Tempe (USA). Dept. of Mathematics; San Diego State Univ., CA (USA). Dept. of Mathematical Sciences). (Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Chicago Univ., IL (USA). Dept. of Chemistry; Arizona State Univ., Tempe (USA). Dept. of Mathematics). 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752686/JAW.

We show that Weinhold's metric cannot be introduced on the equation of state surface from a Euclidean metric in the ambient space of all extensive state variables, whereas it can be induced if the ambient space is assumed only to have a Riemannian metric. This metric, however, is not unique.

25522 **(NBI-HE—87-30) Recent results for random networks of automata.** Flyvbjerg, H. (Niels Bohr Inst., Copenhagen (Denmark)). May 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752693/JAW.

After a very brief historical and contextual introduction to random networks of automata we review recent numerical and analytical results. Open questions and unsolved problems are pointed out and discussed. One such question is also answered: it is shown that the size of the stable core can be used as order parameter for a transition between phases of frozen and chaotic network behavior. A mean-field-like but exact selfconsistency equation for the size of the stable core is given. A new derivation of critical parameter values follows from it.

25523 **(NBI-HE—87-59) SO(4) x U(1) extended N=4 superconformal algebra in a defected Ising model.** Henkel, M.; Patkos, A. (Essen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 - Physik). (Niels Bohr Inst., Copenhagen (Denmark)). Sep 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752698/JAW.

The critical Ising quantum chain Hamiltonian is solved numerically with 3 independently tuned defects. We show evidence that the spectrum can be interpreted to represent the N=4, SO(4) . U(1) extended superconformal algebra.

25524 **(NORDITA—84/31(prepr.)) Efficiency of Flory approximation.** Obukhov, S.P. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1984. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752707/JAW.

The Flory approximation for the self-avoiding chain problem is compared with a conventional perturbation theory expansion. While in perturbation theory each term is averaged over the unperturbed set of configurations, the Flory approximation is equivalent to the perturbation theory with the averaging over the stretched set of configurations. This imposes restrictions on the integration domain in higher order terms and they can be treated self-consistently. The accuracy $\delta\nu/\nu$ of Flory approximation for self-avoiding chain problems is estimated to be 2-5% for $1 < d < 4$.

25525 **(NORDITA—87/15-P(prepr.)) Z/sub 4/ x Z/sub 4/ symmetry and parafermion operators in the self-dual critical Ashkin-Teller model.** Yang, S.K. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752708/JAW.

The two-dimensional Ashkin-Teller model at the particular point on the self-dual critical line is shown to have the infinite-dimensional symmetry of the parafermion current algebra a la Zamolodchikov and Fateev. This is done by representing the partition function in terms of the level 4 string functions of the affine algebra A/sub 1/. We can then determine the internal symmetry properties of all the primary operators by exploiting the partition functions with any twisted boundary conditions associated with the global symmetry of the model. The quarter- and half-integer spin parafermion operators with continuously varying exponents are found.

25526 **(NORDITA—87/17-P(prepr.)) Statistical mechanics of paths with curvature dependent action.** Ambjoern, J.; Durhuus, B.; Jonsson, T. (Niels Bohr Inst., Copenhagen (Denmark); Copenhagen Univ. (Denmark). Matematisk Inst.). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). 1987. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752709/JAW.

We analyze the scaling limit of discretized random paths with curvature dependent action. For finite values of the curvature coupling constant the theory belongs to the universality class of simple random walk. It is possible to define a non-trivial scaling limit if the curvature coupling tends to infinity. We compute exactly the two point function in this limit and discuss the relevance of our results for random surfaces and string theories.

25527 **(UCID—21220) CAVEAT: A 3-D ale code based on a Godunov method.** Hall, M.S. (Lawrence Livermore National Lab., CA (USA)). 17 Sep 1987. Contract W-7405-ENG-48. 43p. NTIS, PC A03. Order Number DE88007000/JAW.

CAVEAT is a three-dimensional Lagrangian computer code that solves the Euler equations of motion for a compressible fluid. Through the option of continuous rezoning, the code can be run in

an Eulerian, rezoned Lagrangian, or Lagrangian mode. CAVEAT is thus well-suited to solving problems involving severe distortions and interfacial slip. Velocities and pressures on cell faces are found using a noniterative, approximate Riemann solver developed by J. Dukowicz, and the solution is advanced in time using a Godunov method. This shock capturing technique results in good resolution of strong shocks, which are typically spread over two or three computational cells. The following report contains an overview of some of the major features of the code. A derivation of the approximate Riemann solver is given and we present results obtained for a selection of well-known test problems.

25528 **Comments on the one-dimensional hydrogen atom [Am. J. Phys. 27, 649 (1959); Am. J. Phys. 37, 1145 (1969); Am. J. Phys. 44, 1064 (1976).** Hammer, C.L.; Weber, T.A. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011). *American Journal of Physics;* 56: No. 3, 281-282(Mar 1988). Contract W-7405-ENG-82.

Extraneous solutions to the Schroedinger equation are discussed. (AIP)

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REFER ALSO TO CITATION(S) 25277, 25295, 25316, 25618, 25625, 25631, 25632, 25633, 25637, 25639, 25680

25529 **(CEA-CONF—9198) Evolution of a transient plasma.** Gauthereau, C.; Stephan, Y. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). Jun 1987. 14p. (CONF-870633—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752218/JAW.

From 4. workshop on nonlinear evolution equations and dynamical systems; Montpellier, France (11 Jun 1987).

Using the finite element method, we followed the evolution of a collisionless pulsed plasma under the effect of an alternating voltage established between two plates. In our model ions are described by the hydrodynamic equations while electrons are supposed to be in thermal equilibrium. The electric field is obtained by the POISSON-BOLTZMANN equation and submitted to a constraint due to the total number of electrons in the experimental device.

25530 **(CLM-R—259) Measurement of the attenuation of optical fibres (fibres optiques QSF-W-600 μm) in the ultraviolet region.** Field, A.R.; Thompson, J.W. (UKAEA Culham Lab., Abingdon). Jul 1987. 11p. H.M. Stationery Office, London, price Pound 4.00.

The attenuation of Fibres Optiques QSF-600-W optical fibres was measured in the wavelength range from 2300A to 7000A to assess their suitability for use on HBTX1A diagnostics. The primary use intended for the fibres was to relay CV (2171A) light to a spectrometer for multichord doppler ion temperature and plasma rotation measurements. Manufacturers data was available for the attenuation in the wavelength region 4000A to 7000A so the present work was undertaken to extend measurement into the region of 2200A to 4000A. The highest acceptable attenuation for the intended applications was 3.0dBm/sup -1/ and the highest measured attenuation was 3.8+/-1.0 dBm/sup -1/ at 2300A confirming their suitability for this purpose.

25531 **(CONF-880162—1-Vugraphs) Pellet ablation and transport studies.** Houlberg, W.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006413/JAW.

From CIT-ITER plasma fueling workshop; Oak Ridge, TN, USA (27 Jan 1988).

This collection of vugraphs describes the impact of pellet injection on plasma confinement. (JDH)

25532 **(CONF-880163—1-Vugraphs) Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks.** Isler, R.C.; Rowan, W.L. (Oak Ridge National Lab., TN (USA); Texas Univ., Austin (USA). Fusion Research Center). 1988. Contract AC05-84OR21400. 45p. NTIS, PC A03. Order Number DE88006183/JAW.

From Meeting on density limits and disruptions; Abingdon, UK (26 Jan 1988).

It has been observed in several tokamaks that the confinement of test impurities increases dramatically when operating near density limits. The characteristics of the working gas transport coefficients also change character under these conditions. These changes appear to be caused by a suppression of the anomalous transport mechanisms. This series of vugraphs investigates the role of these changes in initiating disruptions.

25533 **(DOE/ER/40093—T1-Vol.9) Physics through the 1990s: Plasmas and fluids.** (National Research Council, Washington, DC (USA). Physics Survey Committee). 1986. Contract FG05-83ER40093. 336p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE88006398/JAW.

This survey of plasma physics and fluid physics briefly describes present activities and recent major accomplishments. It also identifies research areas that are likely to lead to advances during the next decade. Plasma physics is divided into three major areas: general plasma physics, fusion plasma confinement and heating, and space and astrophysical plasmas. Fluid physics is treated as one topic, although it is an extremely diverse research field ranging from biological fluid dynamics to ship and aircraft performance to geological fluid dynamics. Subpanels, chosen for their technical expertise and scientific breadth, reviewed each of the four areas. The entire survey was coordinated and supervised by an Executive Committee, which is also responsible for the Executive Summary of this volume. Wherever possible, input from recent Advisory Committees was used, e.g., from the Magnetic Fusion Advisory Committee, the Space Science Board, and the Astronomy Survey Committee. This volume is organized as follows: An Introduction and Executive Summary that outlines (1) major findings and recommendations; (2) significant research accomplishments during the past decade and likely areas of future research emphasis; and (3) a brief summary of present funding levels, manpower resources, and institutional involvement; and the subpanel reports constitute Fluid Physics, General Plasma Physics, Fusion Plasma Confinement and Heating, and Space and Astrophysical Plasmas. An important conclusion of this survey is that both plasma physics and fluid physics are scientifically and intellectually well developed, and both ares are broad subdisciplines of physics. We therefore recommend that future physics surveys have separate volumes on the physics of plasmas and the physics of fluids.

25534 **(DOE/ER/53206—10) Theoretical studies of the heating of toroidal plasmas with radiofrequency electromagnetic radiation: Progress report, July 1, 1987-June 30, 1988.** Swanson, D.G.; Wersinger, J.M.; Hanson, J.D. (Auburn Univ., AL (USA). Dept. of Physics). Feb 1988. Contract FG05-85ER53206. 87p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006913/JAW.

Two main studies have been made since the beginning of this grant. First, Inho Park has obtained results for quasi-mode decay at lower hybrid geometric foci using an analytic model. Many lower hybrid rays have been traced to assess the wide occurrence of true geometric line foci. Three regimes for daughter wave amplification have been identified in three regions of the foci. The problem of obtaining realistic pump wave amplitudes is clearly defined and cannot be obtained from focusing. Second, a lower hybrid ray tracing code has been built for ETR, using a numerical equilibrium. The last details of coding up and graphics generation are being worked out. The goal is to study both current drive and the possibility to burn through the distribution functions to improve accessibility. For the remainder of this grant period we will start work on Ion Bernstein Wave Heating in collaboration with Oak Ridge.

25535 **(DOE/ET/51013—238) Equilibrium and stability of the Tara tandem mirror experiment.** Lane, B.G. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Sep 1987. Contract AC02-78ET51013. 20p. (CONF-8709203—2; PFC/CP—87-19). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006259/JAW.

From International school of plasma physics; Varenna, Italy (1 Sep 1987).

The MHD equilibrium and stability of the Tara machine is analyzed. MHD equilibrium theory is shown to predict small distortions away from circular pressure surfaces in the Tara experiment due to parallel currents generated in the nonaxisymmetric anchors. Central cell fluctuations are dominated by radially rigid, m = 1 flute modes in which the entire column oscillates about the machine axis. These modes can be stabilized by outboard quadrupole anchors, but are also sensitive to gas input and central cell ion cyclotron heating (ICH) power levels. During the strong endloss reduction realized in plugging experiments, the source for the anchor plasma is cut off with a consequent decline in ion beta leading to a reappearance of central cell flute modes. A magnetic divertor installed at the central cell mid-plane in order to ameliorate this difficulty has significantly enlarged the stable operating parameter regime. Axially localized instabilities are clearly observed in the plug cells during the application of plug ICH and are conjectured to exist during the application of axicell ECH. 23 refs., 8 figs.

25536 **(DOE/ET/51013—239) Results from the Tara tandem mirror experiment.** Lane, B.G. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Sep 1987. Contract AC02-78ET51013. 21p. (CONF-8709203—3; PFC/CP—87-20). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006258/JAW.

From International school of plasma physics; Varenna, Italy (1 Sep 1987).

A summary of the experimental results from the Tara tandem mirror experiment is presented. Optimization of the fueling configuration, slow wave ion cyclotron heating from a magnetic "plateau" using an aperture antenna design, and enhanced stabilization from a magnetic divertor have allowed the attainment of a stable start up plasma (T/sub i,perpendicular/ = 800 - 1500 eV, n/sub e/ = 4 - 5 x 10^{12} cm^{-3}, T/sub e/ = 70 - 80 eV). Plugging experiments using radiofrequency waves near the plug midplane ion cyclotron frequency have proved successful in reducing endloss, while simultaneously leading to an increase in central cell density. The plugging potentials have been limited to approximately the ion parallel temperature. This limitation is due to low frequency instabilities localized in the plug. Axial plugging experiments using electron cyclotron (ECH) resonant microwave radiation in the plug cells have had ambiguous results. Endloss reductions up to 100% have been achieved without build-up of central cell densities or the appearance of the reflected particles at the other end of the machine. We conjecture that rapid radial losses accompany the use of ECH, although the mechanisms for this loss remain unidentified. 9 refs., 9 figs.

25537 **(DOE/ET/51013—243) Studies of high charge-state ions in the constance B quadrupole mirror.** Petty, C.C.; Smith, D.K.; Smatlak, D.L.; Goodman, D.L. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Nov 1987. Contract AC02-78ET51013. 21p. (CONF-8711107—8; PFC/CP—87-23). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006257/JAW.

From International conference on ECR ion sources and their applications; East Lansing, MI, USA (16 Nov 1987).

Experiments have been initiated into the confinement and extraction physics of high charge-state ions in an ECRH mirror plasma. ECRH mirrors are well suited for producing high Z ions because the hot electron temperature (>100 keV) is sufficient to fully strip heavy ions. The charge state distribution (CSD) of the ion endloss and the ion endloss temperatures have been measured using a time-of-flight analyzer. The CSD of the confined ions has been measured using a VUV spectrometer. Applying ICRH to the plasma was found to lower the Z/sub eff/ of the confined ions while raising the Z/sub eff/ of the extracted ions. The experimental results are compared to theoretical models which include Pastukhov, flow, and spatial-diffusion confinement times. 12 refs., 16 figs.

25538 **(DOE/ET/53088—306) Interaction of a strong vortex with decaying turbulence.** Terry, P.W. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jan 1988. Contract FG05-80ET53088. 12p. (IFSR—306). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88007102/JAW.

The evolution of a localized, axially symmetric vortex under the action of shear stresses associated with decaying two-dimensional turbulent vorticity which is inhomogeneous in the presence of the vortex is studied analytically. For a vortex which is sufficiently strong relative to the coefficient of turbulent eddy viscosity, it is shown that turbulent fluctuations in the vortex interior and diffusion of coherent vorticity by the turbulence localize to the vortex periphery. It is also found that the coefficient of diffusion is small compared to the coefficient of eddy viscosity. 8 refs.

25539 **(DOE/ET/53088—308) Radial fluctuation scale of ion temperature gradient driven turbulence.** Terry, P.W.; Leboeuf, J.N.; Diamond, P.H.; Thayer, D.R.; Sedlak, J.E.; Lee, G.S. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jan 1988. Contract FG05-80ET53088. 24p. (IFSR—308). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007103/JAW.

We show that ion temperature gradient driven turbulence supports fluctuations with broader radial scales than those inferred previously on the basis of the eigenfunction with lowest radial eigenmode number. These fluctuations of greater radial extent are more strongly excited and are shown to result in fluctuation levels and transport coefficients which can be considerably larger than those previously predicted. It is expected that transport of this nature would force ion temperature and density profiles to near-marginal stability in neutral beam and ICRF heated plasmas. 14 refs., 6 figs.

25540 **(DOE/ET/53088—309) Wave energy flow conservation for propagation in inhomogeneous Vlasov-Maxwell equilibria.** Kull, H.J.; Berk, H.L.; Morrison, P.J. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Feb 1988. Contract FG05-80ET53088. 19p. (IFSR—309). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006705/JAW.

Wave energy flow conservation is demonstrated for Hermitian differential operators that arise in the Vlasov-Maxwell theory for propagation perpendicular to a magnetic field. The energy flow can be related to the bilinear concomitant, for a solution and its complex conjugate, by using the Lagrange identity of the operator. This bilinear form obeys a conservation law and is shown to describe the usual WKB energy flow for asymptotically homogeneous regions. The additivity and uniqueness of the energy flow expression is discussed for a general superposition of waves with real and complex wave numbers. Furthermore, a global energy conservation theorem is demonstrated for an inhomogeneity in one-dimension and generalized reflection and transmission coefficients are thereby obtained. 9 refs.

25541 **(ENEA-RT-FUS—86-7, pp 5-15) FTU Frascati tokamak upgrade.** Andreani, R. (ENEA, Frascati (Italy). Centro Ricerche Energia). 1987. NTIS (US Sales Only), PC A06. Order Number DE87752631/JAW. (CONF-860917—).

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

The FTU (Frascati Tokamak Upgrade) aims to achieve high values of ntau and temperature. High densities and confinement times should be reached by the use of high magnetic fields (8T) and reduced size and a strong lower hybrid additional heating (8 MW at 8 GHz) will be applied to raise plasma temperature. The main features of the machine are: liquid nitrogen cooling, to reduce controll, all stainless steel vacuum chamber, liner and limiter structures. The machine is presently in an advanced construction stage. The new 250 MVA flywheel generator and few component parts are already in Frascati in the new buildings and the project team is pushing to keep the envisaged timing that should see the first operation of the machine at room temperature at the end of 1987.

25542 **(ENEA-RT-FUS—86-8) Contributions to the course and workshop on basic and advanced fusion plasmas diagnostic techniques.** Bartiromo, R. (ENEA, Rome (Italy)). 1987. 66p. (CONF-860902—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88701723/JAW.

From Course and workshop on basic and advanced fusion plasma diagnostic techniques; Varenna, Italy (3 Sep 1986).

Three papers read at the Course and workshop on basic and advanced fusion plasmas diagnostic techniques held in Varenna from 3 to 13 September 1986 and prepared by searchers of Fusion Department of ENEA are reported.

25543 (ENEA-RT-FUS—86-8, pp 5-48) **High resolution X ray spectroscopy.** Bartiromo, R. (ENEA, Frascati (Italy). Centro Ricerche Energia). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88701723/JAW. (CONF-860902—).

From Course and workshop on basic and advanced fusion plasma diagnostic techniques; Varenna, Italy (3 Sep 1986).

This paper is devoted to a detailed discussion of the physical processes which are responsible for the emission spectra of H-like and He-like ion of high Z impurities in low density plasmas. The application of high resolution X-ray spectroscopy to the diagnostic of tokamak plasmas is also discussed and examples of the results obtained are presented. 51 refs.

25544 (ENEA-RT-FUS—86-8, pp 49-55) **FT Thomson scattering.** Santi, D.; Bassan, M.; Brusadin, A. (ENEA, Frascati (Italy). Centro Ricerche Energia). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88701723/JAW. (CONF-860902—).

From Course and workshop on basic and advanced fusion plasma diagnostic techniques; Varenna, Italy (3 Sep 1986).

A new multipoint, multipulse Thomson scattering (TS) has been operating on the FT tokamak since April 1986. The apparatus uses a suitably modified Apollo ruby laser to measure the electron temperature (Tsub(e)) and density (nsub(e)) in seven spatial points along the 20 cm radius, up to four times during a single tokamak discharge. The modifications of both the oscillation and the amplification stages of the laser provide beams with good characteristics (divergence less than 3 mrad, energy 4J) with an adjustable delay of 300 to 500 ms between two successive pulses. The results of the absolute calibration of the apparatus and the first measurements to verify the reliability of the system are presented.

25545 (ENEA-RT-FUS—86-8, pp 56-66) **Observation of lower hybrid waves by CO/sub 2/ scattering on FT.** Orsitto, F.; Frigione, D. (ENEA, Frascati (Italy). Centro Ricerche Energia). 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88701723/JAW. (CONF-860902—).

From Course and workshop on basic and advanced fusion plasma diagnostic techniques; Varenna, Italy (3 Sep 1986).

Results of a CO/sub 2/ scattering experiment on lower hybrid waves at a 2.45 GHz frequency are given. The n-spectrum of LH waves is determined at the plasma center resulting in a high-n depletion with respect to the launched spectrum. Signals are found in the location predicted by a ray-tracing code.

25546 **(IC—86/49) Effect of transitional particles driven by single wave.** Qiu Yunqing; Xia Mengfen. (International Centre for Theoretical Physics, Trieste (Italy); Beijing Univ., BJ (China). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). May 1987. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701821/JAW.

The unperturbed separatrix crossing driven by a single wave in a tokamak plasma is discussed. The separatrix crossing is followed by a mixing process, and a small-scale structure occurs in the distribution function in h-psi plane. The separatrix crossing is a convective process in h-psi plane, and there is a definite crossing channel. The convective flux and the net flux in h-direction are calculated. The separatrix crossing is accompanied by a radial flux, which is composed of a directional flux and a diffusion flux. (author). 7 refs, 6 figs.

25547 **(IC—87/127) On the self-focusing of electric helicons.** Tsintadze, N.L.; El-Ashry, M.Y.; Garuchava, D.P. (International Centre for Theoretical Physics, Trieste (Italy); Academy of Science of the Georgian SSR, Tbilisi (USSR). Inst. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701870/JAW.

The present work is devoted to the investigation of the stationary self-focusing of circularly polarized helicons in a magnetized plasma in the case of ultra-relativistic intensities. It is shown that the larger intensity and effective width at the boundary is the much faster growing self-focusing. (author). 8 refs.

25548 **(IC—87/129) On the self-trapping of an electromagnetic wave in magnetized plasma.** El-Ashry, M.Y.; Berezhiani, V.I.; Pichkhadze, Sh.D. (International Centre for Theoretical Physics, Trieste (Italy); Academy of Sciences of the Georgian SSR, Tbilisi (USSR). Inst. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701872/JAW.

The possibility of relativistic self-trapping of an electromagnetic wave in magnetized plasma is studied. It is shown that in the case of propagation of fast wave packet of electromagnetic wave in plasma, self-trapping is possible due to the effect of relativistic nonlinearity, which is effective even for small amplitudes of the pumping wave. (author). 7 refs.

25549 **(IC—87/140) Factors which affect operation of a plasma focus in various gases.** Smith, A.J. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701882/JAW.

It is shown that the axial transit time t/sub a/ and γ, the ratio of specific heats, are the main factors which affect the operation of a plasma focus in various gases. An energy balance theory is used to explore this dependence. The results are consistent with previous calculations and with experiment. (author). 12 refs.

25550 **(IC—87/143) Modulational instability of electric helicons in a magnetized collisional plasma.** El-Ashry, M.Y.; Papuashvili, N.A. (International Centre for Theoretical Physics, Trieste (Italy); Academy of Sciences of the Georgian SSR, Tbilisi (USSR). Inst. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701885/JAW.

The interaction of a rf electromagnetic wave with a magnetized collisional plasma in the ultra-relativistic case has been investigated to show the effect of the collisions on the modulational instability growth rate. (author). 5 refs.

25551 **(IC—87/151) Kinetic modulational instability of electron cyclotron waves in plasmas.** Shukla, P.K.; Lakhina, G.S. (Bochum Univ. (Germany, F.R.)). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701893/JAW.

The modulation of a large amplitude electron cyclotron wave by non-resonant ion quasi-modes is considered. The growth rate of the kinetic modulational instability is derived. Our results can have relevance to the magnetic fusion as well as to space plasmas with equal electron and ion temperatures. (author). 7 refs.

25552 **(IC—87/153) Megagauss field variation along axis of wire target in laser produced plasma.** Jha, L.N.; Srivastava, M.P. (International Centre for Theoretical Physics, Trieste (Italy); Delhi Univ. (India). Dept. of Physics and Astrophysics). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701895/JAW.

Analytical results for megagauss magnetic field variation for laser produced plasmas are obtained. Laser is irradiated on an Al wire target. The exponential electron density variation is taken as is observed in the experiment of Raven et al. (Appl. Phys. Lett. 1979).

The variation of magnetic field along the axis of wire is computed with experimentally observed variation and the results obtained by computer simulation. B/sub max/ and its variation is found to agree fairly well with experiment. (author). 13 refs, 1 fig.

25553 **(IPP—1/242) Pellet injection with improved confinement in ASDEX.** Kaufmann, M.; Buechl, K.; Fussmann, G.; Gehre, O.; Grassie, K.; Gruber, O.; Haas, G.; Janeschitz, G.; Kornherr, M.; Lackner, K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Washington Univ., Seattle (USA)). Jul 1987. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752044/JAW.

Tokamak discharges with repetitive pellet fueling were investigated in the ASDEX divertor device. The importance of sufficiently high divertor recycling for successful density build-up in the bulk plasma was demonstrated. In OH-heated discharges with high recycling an energy confinement time of 160 ms was reached, the normal values being 80 ms in the roll-over region. The peaked density profiles in this cases were accompanied by reduced or suppressed sawtooth activity and finally ended in a phase of strong central impurity accumulation. The particle transport was characterized by strong, non-classical inward drift, while the improved energy transport can be explained by two alternatives: (1) a local model which assumes neo-Alcator chi/sub e/ for the electrons and an chi/sub i/ = 3chi/sub neocl/ for the ions in the gas puff cases reduced to chi/sub i/ = chi/sub neocl/ for the optimum pellet cases; (2) a profile consistency picture were T/sub e/(a) determines the energy confinement. Low-power, NI-heated discharges with pellet fueling behave like ohmic discharges, while for high power in the L-mode no successful density build-up was possible, and tau/sub E/ was not improved. The H-regime was extended to anti n/sub e/ = 1.2x10/sup 20/ m/sup -3/ by the injection of pellets. In this case a density build-up takes place, but a further density profile peaking could not be observed.

25554 **(IPP—1/244) Three-fluid magneto-hydrodynamical simulation of plasma focus discharges.** Behler, K.; Bruhns, H. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1987. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752017/JAW.

A two-dimensional, three-fluid code based on the two-fluid Potter code was developed for simulating the plasma focus discharge. With this code it is possible to treat the neutral gas in addition to the plasma components and to model the ionization and recombination phenomena. Thus one can study the sheet dynamics in a plasma focus and investigate effects such as the occurrence of residual gas (or plasma) density behind the current sheet in the rundown phase. This is a prerequisite to the occurrence of leak currents, which are one of the causes limiting the performance of large plasma focus devices. It is shown that fast operating foci with small dimensions behave favourably compared with the 'classical' Mather focus with long coaxial electrodes.

25555 **(IPP—5/16) Resistive ballooning stability of ASDEX equilibria.** Zehrfeld, H.P.; Grassie, K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752018/JAW.

Experiments on the maximum attainable beta values of ASDEX discharges show that the limits for this parameter lie in the range of theoretical predictions. In a previous publication we have attempted to theoretically identify the corresponding instabilities. While no significant correlation to global plasma instabilities could be found, the two-dimensional MHD equilibria calculated on the basis of ASDEX experimental parameters turned out to be close to the marginal ideal ballooning limit. In the present work we extend this investigation to resistive ballooning modes. Separatrix bounded as well as limiter controlled plasma equilibria are considered. Because of the small aspect-ratio of ASDEX (A $\simeq$ 4) all equilibrium as well as stability calculations are performed in full toroidal geometry. After the formulation of a system of four equations describing the resistive evolution of velocity and magnetic fields in the high-m stability limit in coordinate-invariant form and its Fourier approximation in the neighbourhood of a localization field line, we solve the resulting quasi-mode equations applying methods of finite-element discretization. We find complex growth rates γ with positive real part for values of the toroidal mode number n below 100. Calculated values of Re{γ} $\leqq$ 10/sup -3//tau/sub A/ s/sup -1/ (with tau/sub A/ being the Alfven time) are small and therefore in agreement with the experimentally observed non-disruptive behaviour at the β/sub p/- limit. Thus we believe that the characteristic signatures which govern ASDEX high-β/sub p/ discharges can be explained by resistive ballooning modes.

25556 **(IPP—6/267) Exact resonance broadening theory of diffusion in random electric fields.** Salat, A. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1987. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752019/JAW.

Particle motion in random electric fields is considered on the assumption that orbit stochasticity causes the volocity increments at different times to be independent random events with Gaussian probabilities (Wiener process). The resulting resonance broadening term is substantially different from the one derived by Dupree. The diffusion coefficient D is found to be a function of t/t/sub d/, where t/sub d/ is the average diffusion time across the resonance region in velocity space. For t/t/sub d/ << 1 the diffusion is quasilinear. Dupree's high-amplitude case (autocorrelation time >> trapping time) with D $\simeq$ (<E/sup 2/>)3/4 turns out to be inconsistent with a diffusion process: the particles are lost from the resonance region before diffusion is established.

25557 **(IPP—6/268) Hamiltonian formulation and statistics of an attracting system of nonlinear oscillators.** Tasso, H. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Oct 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752038/JAW.

An attracting system of r nonlinear oscillators of an extended van der Pol type was investigated with respect to Hamiltonian formulation. The case of r=2 is rather simple, though nontrivial. For r>2 the tests with Jacobi's identity and Frechet derivatives are negative if Hamiltonians in the natural variables are looked for. Independently, a Liouville theorem is proved and equilibrium statistics is made possible, which leads to a Gaussian distribution in the natural variables.

25558 **(IPP—III/115) ICRF heating analysis on ASDEX plasmas.** Itoh, S.I.; Itoh, K.; Fukuyama, A.; Morishita, T.; Steinmetz, K.; Noterdaeme, J.M. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Hiroshima Univ. (Japan). Inst. for Fusion Theory; Okayama Univ. (Japan). School of Engineering). Aug 1987. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752037/JAW.

ICRF (ion cyclotron range of frequencies) waves heating in ASDEX tokamak is analysed. The excitation, propagation and absorption are studied by using a global wave code. This analysis is combined with a Fokker-Planck code, and the generation of fast ions and thermalization of the absorbed power are obtained theoretically. The wave form in the plasma, the loading resistance and reactance of the antenna are calculated for both the minority ion heating and the second harmonic resonance heating. Attention is given to the change of the antenna loading associated with the L/H transition. Optimum conditions for the loading are discussed. In the minority heating case, the tail generation and thermalization are analyzed. Spatial profiles of the tail-ion temperature and the power transferred to the bulk electrons and ions are obtained. Central as well as off-central heating cases are investigated. The ratio of the electron heating power is obtained. Finally, the effect of the reactive electric field is discussed in connection with rf losses and impurity production.

25559 **(IPP—III/121-B) Periodic multichannel Thomson scattering in ASDEX.** Roehr, H.; Steuer, K.H.; Murmann, H.; Meisel, D. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jul 1987. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752021/JAW.

The optical and electronic design of the Thomson scattering experiment in the ASDEX-Tokamak is described. This Thomson scattering system is employed as a standard diagnostic for the eval-

uation of electron temperature and density simultaneously at 16 spatial points in ASDEX. The light source is a Nd-YAG laser emitting at 1.06 μm wavelength, which is capable of delivering 60 pulses per second for a period of about 7 sec. This period includes the whole ASDEX plasma discharge. The scattered light is detected by Si-avalanche diodes. Density calibration is carried out by rotational anti-Stokes Raman scattering from molecular hydrogen. The system is capable of measuring densities as low as 5x10/sup 12/ cm/sup -3/ and electron temperatures in the range from 150 eV to 5 keV. The data-processing system and the calculations which lead to the final output of Te/Ne-profiles are discussed. Examples of profile measurements are given showing the possibilities of the system under various plasma conditions. Technical details of the system are described in tables listed in the appendix.

25560 **(IPP—III/122) Influence of neutron scattering and source extent on the measurement of neutron energy spectra at ASDEX.** Huebner, K.; Baetzner, R.; Roos, M.; Robouch, B.V.; Ingrosso, L.; Wurz, H. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1987. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752036/JAW.

The problem of nuclear emulsion measurements at ASDEX is considered. Besides the application of the VINIA-3DAMC software, this needs a description of the plasma neutron source, a model of the ASDEX structure, and calculation of the response of the nuclear emulsion to the incoming spectral neutron fluence. The latter is essential for comparing the numerical results with measurements at ASDEX. To treat this part, the NEPMC software was developed. The aim of the present work is to demonstrate the feasibility, reliability and usefulness of the method. Therefore simplified treatments for the ASDEX model, the plasma neutron source and the track statistics in the NEPMC software were used. Such calculations are of interest not only for nuclear emulsion measurements as well as any other neutron diagnostics, but also for all problems of neutron shielding for other diagnostics.

25561 **(IPP—III/123) Mode coupling structure in Tokamaks.** Lisitano, G. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Sep 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752020/JAW.

A m=1, helically displaced current channel was identified in the ASDEX plasma interior during m=2 mode activity. This was achieved by means of simultaneous data obtained from a new gradient sensitive schlieren diagnostic and B/sub P/ measurements. They clearly show a rotational-transform-dependent coupling mechanism between the driver m=1 current helix and the m=2 perturbation of the bulk current surrounding it. The mechanism is of central importance for the development of the instability and for the theoretical understanding of mode coupling, mode locking and other varieties of mode structures in plasma.

25562 **(IPP—III/124) Information of Z/sub eff/ from the sawtooth-performances in the center of ohmic tokamak discharges.** Eberhagen, A. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Sep 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752039/JAW.

Achievement of information on the mean effective ion charge in the center of ohmic tokamak discharges from sawtooth-relaxations of the plasma is considered. This method is found to supply trustworthy results for usual tokamak parameters. While its application requires some effort in data analysis, it can provide a valuable determination of Z/sub eff/-data, independent of the information from bremsstrahlung radiation losses of the plasma.

25563 **(IPPJ—811) Plasma heating by a magnetosonic shock wave through resonant ion acceleration.** Ohsawa, Yukiharu. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88780054/JAW.

Resonant wave-particle interactions in magnetosonic shock waves are studied by theory and simulation. We evaluate the number of ions trapped by a perpendicular laminar shock in a finite beta plasma and obtain the amount of shock heating due to resonant ion acceleration in terms of the Mach number and upstream plasma parameters. Some effects of trapped ions on shock waves are also discussed. In addition, it is shown that a laminar oblique shock can reflect some electrons by a magnetic mirror effect, in spite of a large positive potential in the shock region. These theoretical predictions are confirmed by a 1 - 2/2 dimension, fully relativistic, fully electromagnetic particle simulation with full ion and electron dynamics.

25564 **(IPPJ—814) Self-adjusting mechanism and plasma dynamo in a reversed field pinch.** Masamune, S.; Oshiyama, H.; Nagata, A.; Arimoto, H.; Yamada, S.; Sato, K.I. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1987. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88780057/JAW.

Equilibrium of the STP-3(M) reversed field pinch has been studied by changing the discharge conditions. With increasing the magnetic Reynolds number, the values of field reversal ratio F and pinch parameter θ tend to be kept constant by the self-adjusting mechanism which is closely related to the plasma dynamo generating the toroidal flux. When we control only the Ohmic input power, this self-adjusting mechanism keeps the value of inductive volt second divided by the toroidal flux constant and prohibits the plasma from attaining the helical equilibrium state.

25565 **(IPPJ—837) Limit of possible operation of crescent and bean shaped tokamaks.** Naitou, H.; Yamazaki, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1987. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752303/JAW.

The maximum attainable beta values which can be expected by the crescent (BEAN1) and rounded bean (BEAN2) shaped tokamaks are obtained numerically by using the linear ideal MHD stability analysis code ERATO. The current profiles are optimized with the fixed pressure profile for the higher beta value keeping Mercier, high n ballooning, and n = 1 kink modes stable (n is the toroidal mode number). The plasma poloidal cross-sections are inscribed in the rectangle with aspect ratio of 3 and ellipticity of 2. The confocal wall, with the distance from the plasma surface being equal to the plasma horizontal minor radius, is assumed for the stability against the kink mode. Triangularity and indentation dependences of the maximum beta value are investigated carefully. The beta value of 10 - 17 percents is obtained depending on the shape and triangularity (indentation). It is also shown that the coefficient of the Troyon-type beta scaling enhances for the indented plasma. In the case of small indentation, the BEAN1 shape tokamak characterized by mild indentation and high triangularity shows higher beta value than BEAN2. For strong indentation, the BEAN2 shape tokamak gives highest beta value, although this configuration is unstable at low beta for the n = 1 mode; the operational scenario to reach the maximum beta must be carefully planned. For equilibria with sufficient indentation, the closer wall will largely enhance the maximum beta value because the n = 1 kink mode is limiting beta and the ballooning beta boundary is much higher.

25566 **(IPPJ—838) Volume produced H/sup -/, D/sup -/ ion source for proton accelerator and thermo-nuclear fusion research by sheet plasma (3).** Uramoto, Joshin. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752304/JAW.

The volume produced H/sup -/ ion current is extracted from the outside region of a high efficiency sheet plasma of width ~ 25 cm, thickness ~ 0.8 cm and length along a weak magnetic field ~ 30 cm. The number of extraction apertures (6 mm phi) is changed from 9 to 301. With a high discharge anode current of 150 A and a H/sub 2/ gas pressure of 2.0 x 10/sup -3/ Torr, the extracted H/sup -/ ion current at 4 kV is about 2.0 A in a case of 301 apertures (160 cm/sup 2/, transparency ~ 50 %). The H/sup -/ ion current is nearly proportional to the number of apertures, and the H/sup -/ ion current density in one aperture is about 24 mA/cm/sup 2/. Thus, a H/sup -//D/sup -/ ion source based on the sheet plasma is proposed for a future thermonuclear fusion research.

25567 (IPPJ—840) Wavepacket propagation and current startup near the lower hybrid frequency in the torus. Ohkubo, K.; Matsumura, Y.; Mizuno, M.; Matsuoka, M.; Matsuura, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1987. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752305/JAW.

In addition to the two-dimensional propagation of wavepacket, electron heating and current drive by a lower hybrid wave in afterglow plasmas are investigated in a small torus. Because the wavepacket, which has a wide frequency spectrum, spreads in space and time due to dispersion, the pulse width of a received wavepacket accompanied with frequency shift increases. The experimental results including the direct observed group and phase velocities agree with the theoretical analysis. Lower hybrid waves with low power (< 10 W and $\simeq 100$ μs) above the threshold power ($\simeq 0.3$ W) are observed which heat electrons and drive the toroidal current. The power threshold is related to the power dependence on parametric instability. It is pointed out that parametrically excited lower hybrid waves take part in both electron heating and filling up the spectral gap which is closely related to current startup.

25568 (IPPJ—844) Long wavelength vortices of low frequency interchange modes. Pavlenko, V.P.; Sanuki, Heiji. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Sep 1987. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752306/JAW.

Nonlinear coupled equations describing the low frequency interchange modes in a plasma with small fraction of the hot electron component are derived on the basis of multi-fluid equations. Stationary vortex solutions in a long wavelength limit are obtained in a plasma stabilized by the charge unconvering effect instead of the finite Larmor radius effect. The solution takes a form of a pair of localized vortices, rotating in opposite directions and moving with a constant velocity in direction perpendicular to the magnetic field. Linear dispersion relation is studied in detail. The dispersion relation of vortex, relating the propagation velocity to the core size of vortex is examined for typical parameters in bumpy torus experiments. Consequently, the positive and negative branches of the propagation velocity for the fixed size of vortex are also found.

25569 (IPPJ—845) Magnetohydrodynamic stability of spheromak plasma in toroidal flux conserver with rectangular cross section, 3. Stability for symmetric modes. Kaneko, Shobu; Wang, Yi-Ping; Tsutsui, Hiroaki. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Sep 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752307/JAW.

The purpose of this short note is to apply Edenstrasser's condition to the spheromak plasma in the toroidal flux conserver with the rectangular cross section and is to supplement the previous paper. The application of this condition to the spheromak plasma with optimized pressure distribution is also made in this note. (J.P.N.).

25570 (IPPJ—846) Stability of spheroidal spheromak plasma by use of force-free approximation. Kaneko, Shobu; Tsutsui, Hiroaki. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Sep 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752308/JAW.

The Woltjer-Taylor method is applied to spheromak plasmas in spheroidal flux conservers. As models of the flux conserver, both oblate and prolate spheroidal vessels with a center conductor are used. The plasma is not assumed to be nearly spherical, and the Rayleigh-Ritz method and the finite element method are used to evaluate the eigenvalues. The oblate spheromak is shown to be stable irrespective of the shape of the flux conserver. Though the prolate spheromak is unstable if there is no center conductor, it can be stable if the center conductor is installed.

25571 (IPPJ—849) Magnetic fluctuation behaviour of current termination in reversed field pinch. Nagata, A.; Arimoto, H.; Masamune, S.; Yamada, S.; Sato, K.I.; Tamaru, T. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Sep 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752333/JAW.

Growth of the magnetic fluctuations due to the $m = 1$ and $m = 2$ modes, where m is the poloidal mode number, and succeeding phase-lock of these modes have been found as the precursor phenomena of the rapid destruction of the plasma column (current termination) in reversed field pinch (RFP). By deepening the field reversal at the wall, these precursors disappear, and the plasma current duration becomes much longer. Thus the current termination is closely connected with the growth of MHD instabilities with the $m = 1$ and $m = 2$ modes.

25572 (IPPJ—850) Monte Carlo analysis of neoclassical transport for a compact helical system. Chen, T.S. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Oct 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752335/JAW.

Neoclassical confinement behaviour in the realistic field configurations of a low aspect ratio compact helical system (CHS) is analysed numerically by Monte Carlo simulation. Both diffusion coefficient and particle confinement time are used as parameters for transport behaviour assessment. The results of Monte Carlo analysis indicate that in the CHS plasma, the dependence of transport on collisionality is distinctly different between ion species and electron species. The $1/\nu$ law disappears in the ripple trapped ion regime since a great number of ripple trapped ions is just lost in this regime due to the low aspect ratio and the moderate magnetic field strength. On the other hand, electron transport does have its $1/\nu$ regime since very few electrons are lost. The applied ambipolar potential can substantially improve CHS ion transport; however, does not make obvious influence on electron transport within the collision regimes one concerned. Consequently, the electron transport may become a crucial problem comparing with the ion transport at rather long mean free path collisionality. Moreover, the results also show that the employment of different helical ripple modulations can leads to a 1.5 - 3 times difference of the ion confinement time and a 4 times difference of the ion diffusion coefficient at the typical plasma temperature(500 ev) and density(5 x 10/sup 13//cm/sup 3/). Thus it is possible to decrease the CHS ion diffusion coefficient level to approach that of the stellarators with rather high aspect ratios but without helical ripple modulations, say, the Heliotron-E. Finally it is noted that an enough high helical ripple modulation would display its best action on the overall ion confinement performance under situations where a negative ambipolar potential exists.

25573 (JAERI-M—87-177) Lower hybrid current drive models and their verification with ASDEX data. Conceptual design study of FY86 FER. Yoshioka, Ken; Okazaki, Takashi; Matsuura, Hideaki; Yamamoto, Takumi; Sugihara, Masayoshi; Fujisawa, Noboru. (Japan Atomic Energy Research Inst., Tokyo). Oct 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752340/JAW.

Two models for evaluating the lower hybrid current drive efficiency in the presence of a DC electric field are developed and their results are compared with experimental data from the ASDEX tokamak. The first model is based on an one-dimensional Fokker-Planck equation combined with a radial wave propagation equation. The second model is an extension of the two-dimensional "adjoint model" which was originally developed by Fisch and Karney. The calculated steady state (zero DC electric field) current drive efficiency defined by the amount of driven current per unit absorbed of power agrees within 30 % error with the experimental data for each of the two models. However, the one-dimensional Fokker-Planck model fails to predict a dependence of current drive efficiency on the DC electric field, whereas the dependence predicted by the adjoint equation model agrees well, being within the experimental error.

25574 (JAERI-M—87-180) Improvement of plasma confinement due to electron Landau damping in tokamaks. Uehara, Kazuya. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752339/JAW.

It is shown that the E vector/sub RF/ x B vector/sub θ/ drift for resonant electrons in tokamaks does not cancel and forms an inward flux during RF heating with a travelling wave type spec-

trum when an exact treatment of Landau damping in the presence of the magnetic field is performed as an initial value problem, where E vector/sub RF/ is RF electric field and B vector/sub θ/ is poloidal magnetic field. This effect could be the basis of the phenomenon that the plasma confinement is improved during low density lower-hybrid current drive in tokamaks.

25575 **(JAERI-M—87-190) Parameter diagram for lower-hybrid current drive in tokamaks.** Uehara, Kazuya; Nemoto, Masahiro; Nagashima, Takashi. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752337/JAW.

Parameters of lower-hybrid current driven tokamaks are phenomenologically surveyed using the relationships among mode conversion condition, the threshold condition for parametric instability and the accessibility condition. It is shown that the density limit obtained experimentally can be derived from the criteria ω/sub 0//ω/sub L/H > x/sub 0/ and ω/sub pe//ω/sub ce/ < y/sub 0/, where x/sub 0/ is determined by the mode conversion condition and y/sub 0/ is determined by threshold condition of parametric instability or the accessibility condition. The parameter space for lower-hybrid current drive in tokamaks is divided into two regions dominated by parametric instability and accessibility, respectively.

25576 **(JET-R—87-07) Feasibility of alpha particle diagnosis by collective microwave scattering in tokamak fusion experiments.** Hutchinson, I.H. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). Jun 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88752782/JAW.

A review of the physical principles behind the proposed scattering diagnostic for alpha particles is presented. Quantitative expressions are given for the ratio of the alpha-scattered power to the electron-scattered power and background power. The anticipated best-case signal to noise, ignoring coherent pick up, is given. Magnetic field effects can give rise to enhancement of the scattered power due to lower hybrid waves. However, the enhancement is small unless the value of the scattering parameter α is large (≧ 4). Discussion of the likely electron cyclotron emission background is given. The achievable signal to noise in JET appears to be in the range 1 to 100, depending on the assumed parameters. Geometrical choices for optimising the signal to noise are briefly discussed.

25577 **(JET-R—87-08) Description of the impurity transport code 'STRAHL'.** Behringer, K. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1987. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752753/JAW.

'STRAHL' is an interactive, stand-alone impurity transport code which is used on JET for the interpretation of spectroscopic measurements. It calculates the impurity ionisation balance on the basis of given plasma parameters and empirical transport models, using atomic physics data sets especially compiled for that purpose. The paper explains the basic ideas and formulas behind STRAHL in order to allow potential users to design their own special version. (U.K.).

25578 **(JET-R—87-09) Analysis of theoretical problems for ICRF heating in tokamaks.** Hellsten, T.; Appert, K.; Vaclavik, J.; Villard, L. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking; Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1987. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88752754/JAW.

An analysis of theoretical problems for ion cyclotron heating in tokamaks is given. The wave propagation is studied using numerical methods to solve the global problem in which coupling of the wave to the antenna and propagation of the wave are treated in a self-consistent manner. Calculations are made in plane and toroidal geometries. In plane geometry the waves involved in the mode conversion problem can be described numerically whereas in the toroidal case only the corresponding resonance absorption problem can be treated. Mode conversion in toroidal plasmas is discussed for heating at the fundamental cyclotron resonance. The mode conversion surfaces are shown to be aligned along the magnetic surfaces. Focusing of the wave in a small aspect ratio tokamak plasma is shown to depend on the absorption coefficient. For minority heating of hydrogen in a deuterium plasma high energy tails are formed which makes finite gyroradius effects become important for the absorption. The calculated power transfer to the electrons as calculated is compared with that measured experimentally, and shows reasonable agreement between theory and experiments.

25579 **(Juel—2139) First direct measurements of low-Z ion concentrations in TEXTOR using a high current Li-injector.** Bay, H.L.; Hintz, E.; Rusbueldt, D.; Leismann, P.; Aumayr, F.; Winter, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik; Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik; Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik). Jul 1987. 10p. (CONF-870629—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752035/JAW.

From 14. European conference on controlled fusion and plasma physics; Madrid, Spain (22 Jun 1987).

The C/sup 5+/-concentration in the outer plasma region of TEXTOR has been measured using charge exchange spectroscopy with a 15 keV neutral Li-beam. A C/sup 5+/-concentration of about 5% was found.

25580 **(ORAU—88/A-79) Fusion Energy Postdoctoral Research Program, Professional Development Program: FY 1987 annual report.** (Oak Ridge Associated Universities, Inc., TN (USA)). Jan 1988. Contract AC05-76OR00033. 23p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006510/JAW.

In FY 1986, Oak Ridge Associated Universities (ORAU) initiated two programs for the US Department of Energy (DOE), Office of Fusion Energy (OFE): the Fusion Energy Postdoctoral Research Program and the Fusion Energy Professional Development Program. These programs provide opportunities to conduct collaborative research in magnetic fusion energy research and development programs at DOE laboratories and contractor sites. Participants become trained in advanced fusion energy research, interact with outstanding professionals, and become familiar with energy-related national issues while making personal contributions to the search for solutions to scientific problems. Both programs enhance the national fusion energy research and development effort by providing channels for the exchange of scientists and engineers, the diffusion of ideas and knowledge, and the transfer of relevant technologies. These programs, along with the Magnetic Fusion Energy Science and Technology Fellowship Programs, compose the fusion energy manpower development programs administered by ORAU for DOE/OFE.

25581 **(PPLK-R—13) Density fluctuations in currentless high β plasmas in Heliotron E.** Zushi, H.; Motojima, O.; Wakatani, M. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.). Oct 1986. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752310/JAW.

The stability properties of currentless high beta plasmas have been investigated over a wide range of density profiles, n/sub e/(r), by varying the gas puffing conditions and by pellet injection. Line density fluctuations correlated with a pressure-driven MHD instability were measured by a multi channel far infrared laser interferometer. When an increase in the plasma β was accompanied by peaking of n/sub e/(r), line density fluctuations with a frequency of 2 - 5 kHz periodically appeared. The repetition time of the fluctuations was typically 2 - 5 ms. The poloidal and toroidal mode numbers of fluctuations were identified as m = 1 and n = 1, respectively. For plasmas with an extremely peaked profile, density fluctuations corresponding to the m = 3/n = 2 mode were observed. After the latter mode grows, internal disruption occurs. Because of this disruption, n/sub e/(r) rapidly changes from a peaked profile to a broader one. The normalized average radius, r/a, of phase reversal in the density profile variation caused by the disruption is about 0.5, which roughly corresponds to the iota = 2/3 surface, where iota is the rationalized rotational transform. Mode coupling between m = 3/n = 2 and m = 1/n = 1 is the most plausible candidate for triggering the internal disruption. Finally, the onset regions for

MHD instability are summarized for various density profiles and β-values.

25582 **(PPLK-R—14) Studies of pressure profile effects on MHD stability in Heliotron-E using the stellarator expansion.** Rewoldt, G.; Wakatani, M.; Johnson, J.L. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.). Apr 1987. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752311/JAW.

The effects of varying the width of the pressure profile for MHD stability in the Heliotron-E configuration are studied. The calculation employs free-boundary stellarator expansion MHD equilibrium and stability codes, using a model for the Heliotron-E vacuum magnetic field which was constructed by means of a Biot-Savart integration of the exact coil configuration. The calculated critical β values are in the same range as those observed in Heliotron-E experiments.

25583 **(PPLK-R—15) Heating and confinement studies of electron cyclotron resonance heated plasmas in Heliotron E.** Zushi, H.; Sato, M.; Motojima, O. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.). Jun 1987. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752312/JAW.

Rf heating of currentless plasmas is performed at the fundamental and second harmonic cyclotron frequency. The effects of irradiation pattern on plasma heating are studied. In the fundamental heating experiments, the absorbed power profile is determined from the decay of the electron internal energy profile immediately after the rf pulse turned off. Measurements of absorbed power profile by varying the position of the cyclotron resonance layer are compared with the single-pass absorption profiles predicted by a ray tracing code. The profiles of electron temperature, density and ion temperature are studied as a function of the heating power, its profile, and the electron line averaged density. Finally, a scaling of the energy confinement time is obtained by using a regression analysis and compared with a scaling for neutral beam heated plasmas.

25584 **(PPLK-R—16) Measurements of edge turbulence with Langmuir probes in currentless Heliotron E plasmas.** Zushi, H.; Mizuushi, T.; Motojima, O.; Wakatani, M.; Sano, F.; Sato, M.; Iiyoshi, A.; Uo, K. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.). Jul 1987. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752313/JAW.

A study of microscopic fluctuations of density n tilde and potential PHI tilde in the scrape-off layer is performed. Frequency spectra of n tilde and PHI tilde show a strongly turbulent character as observed in many tokamaks. The fluctuation levels of n tilde/n and ePHI tilde/kT/sub e/ are consistent with predictions based on the non-linear collisional drift wave models. Line averaged density and heating power dependences of n tilde/n and ePHI tilde/kT/sub e/ are studied in two types of currentless plasmas, namely electron cyclotron resonance heating (ECRH) plasmas and neutral beam injection (NBI) heating plasmas. Their parametric dependency are compared with the trends of the energy confinement time. Finite β effects on ePHI tilde/sub f//kT/sub e/ and n tilde/n are discussed.

25585 **(UCRL—96672-Rev.1) Mirror theory applied to toroidal systems.** Cohen, R.H. (Lawrence Livermore National Lab., CA (USA)). 25 Aug 1987. Contract W-7405-ENG-48. 18p. (CONF-870908—6-Rev.1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003832/JAW.

From Course and workshop on physics of mirrors, reversed field pinches and compact tori; Varenna, Italy (1 Sep 1987).

Central features of a mirror plasma are strong departures from Maxwellian distribution functions, ambipolar potentials and densities which vary along a field line, and losses, and the mirror field itself. To examine these features, mirror theorists have developed analytical and numerical techniques to solve the Fokker-Planck equation, evaluate the potentials consistent with the resulting distribution functions, and assess the microstability of these distributions. Various combinations of mirror-plasma fetures are present and important in toroidal plasmas as well, particularly in the edge region and in plasmas with strong r.f. heating. In this paper we survey problems in toroidal plasmas where mirror theory and computational techniques are applicable, and discuss in more detail three specific examples: calculation of the toroidal generalization of the Spitzer-Haerm distribution function (from which trapped-particle effects on current drive can be calculated), evaluation of the nonuniform potential and density set up by pulsed electron-cyclotron heating, and calculation of steady-state distribution functions in the presence of strong r.f. heating and collisions. 37 refs., 3 figs.

25586 **Quasilinear theory of the ordinary-mode electron-cyclotron resonance in plasmas.** Arunasalam, V.; Efthimion, P.C.; Hosea, J.C.; Hsuan, H.; Taylor, G. (Plasma Physics Laboratory, Princeton University, P.O. Box 451, Princeton, New Jersey 08544-0451). *Physical Review [Section] A: General Physics;* **37**: No. 6, 2063-2069(15 Mar 1988).

A coupled set of equations, one describing the time evolution of the ordinary-mode wave energy and the other describing the time evolution of the electron distribution function, is presented. The wave damping is mainly determined by T/sub X/, while the radiative equilibrium is mainly an equipartition with T/sub perpendicular/. The time rate of change of T/sub perpendicular/, T/sub X/, particle density (N_0), and current density (J/sub X/) are examined for finite-k/sub X/ electron-cyclotron-resonance heating of plasmas. The effects of collisional broadening and collisional damping are also examined. For blackbody absorbing conditions it is shown that the increase of T/sub perpendicular/ with time in electron-cyclotron-resonance heating is exponential and not linear. From the quasilinear theory it is found that the Ohkawa steady-state current drive efficiency criterion is really a consequence of the conservation laws of energy, momentum, particle density, and the collisional relaxation of the current density.

25587 **Generation of ultrashort x-ray pulses.** Stearns, D.G.; Landen, O.L.; Campbell, E.M.; Scofield, J.H. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **37**: No. 5, 1684-1690(1 Mar 1988).

We report on the characterization of ultrashort (<10 psec at 1 keV), high-brightness (10/sup 20/ photons/sec mm^2 eV into 2π sr at 1 keV) x-ray pulses. The pulses are generated by exciting a preformed laser-produced plasma using an $\sim$1 GW, picosecond laser pulse. Time-resolved measurements of the x-ray emission from a solid Au target are presented as well as the variation in the yield with laser energy and the angle of incidence. Time-integrated x-ray emission yields and spectra are presented for Si, Ti, and Au solid targets. Physical mechanisms responsible for the x-ray generation are discussed.

25588 **One-component plasma bridge function.** Poll, P.D.; Ashcroft, N.W.; DeWitt, H.E. (Laboratory of Atomic and Solid State Physics, Clark Hall, Cornell University, Ithaca, New York 14853-2501). *Physical Review [Section] A: General Physics;* **37**: No. 5, 1672-1678(1 Mar 1988).

A method for extending finite-range Monte Carlo simulation data obtained for the classical one-component plasma (OCP) at $\Gamma = 100$ is presented. It enforces continuity at the simulation range in the Ornstein-Zernike direct correlation function by adding a single Yukawa correction term to an assumed long-range mean-spherical form. In addition, 1/N corrections to the Monte Carlo data are accounted for in order to obtain a satisfactory value for the OCP isothermal compressibility, as compared to the value directly obtained from the Monte Carlo equation of state. The bridge function E(r) is then extracted, and it is found to follow the hard-sphere bridge function at short range, in agreement with the universality hypothesis of Rosenfeld and Ashcroft. However, at long range there are small but nonuniversal corrections whose form is also discussed.

25589 **Power requirements for current drive.** Boozer, A.H. (College of William and Mary, Williamsburg, Virginia 23185). *Physics of Fluids;* **31**: No. 3, 591-595(Mar 1988).

General formulas for the efficiency of current drive in toroidal plasmas are derived using entropy arguments. The highest possible efficiency for current drive in which a high-energy electron tail is formed is shown to be p = E/sub r/j, with p and j the power and current densities and E/sub r/$\approx 0.09 n_{14}$ V/m with n_{14} the electron density in units of 10^{14}/cm.^{3} The electric field required

to maintain the current in a runaway discharge is also shown to equal E/sub r/. If the plasma current is carried by near-Maxwellian electrons, waves that have a low phase velocity, compared to the energy of the electrons with which they interact, can drive a current with Ohmic efficiency, $p = etaj^2$. Such waves were first discussed in the context of current drive by Fisch [Rev. Mod. Phys. 59, 175 (1987)].

25590 **Ion distribution functions during ion cyclotron resonance heating at the fundamental frequency.** Hassan, M.H.A. (International Centre for Theoretical Physics, Trieste, Italy). *Physics of Fluids;* **31**: No. 3, 596-601(Mar 1988).

The distribution function of ions during ion cyclotron resonance heating (ICRH) is studied analytically using a simplified one-dimensional Fokker—Planck equation incorporating ion—ion and ion—electron collisions and rf quasilinear diffusion. By including source and loss terms in the equation, steady-state and time-dependent solutions, which are regular near the origin and vanish at high energies, are found. It is shown that an initially Maxwellian distribution function is transformed by the ICRH into a non-Maxwellian distribution with a tail of energetic ions. The tail is more pronounced when quasilinear diffusion dominates over collisions and losses.

25591 **Electron cyclotron heating correlation with tokamak toroidal plasma rotation.** Lieber, A.J.; Snider, R.T.; Lee, P.; Wojtowicz, S.S. (GA Technologies Inc., San Diego, California 92138). *Physics of Fluids;* **31**: No. 3, 687-691(Mar 1988).

Toroidal rotation of the central plasma core has been observed prior to and during electron cyclotron heating (ECH) in the Doublet III tokamak [in Plasma Physics and Controlled Nuclear Fusion Research 1984, Proceedings of the Tenth International Conference, London (IAEA, Vienna, 1985), Vol. 1, p. 131]. Measurements were made using a curved-crystal Bragg x-ray spectrometer with spectral resolution of $\lambda/\Delta\lambda$ of greater than 19 000 and temporal resolution of 20 msec. Ion rotation velocity was determined from the Doppler shift of x rays emitted from the plasma impurity Ti XXI resonance line. Ion temperatures were determined from the Doppler broadening of this line. A study of purely Ohmic discharges suggests that nonrotating discharges exhibit magnetohydrodynamic activity other than sawtooth oscillations, while those that rotate exhibit sawteeth. Discharges with plasma rotation prior to the appliction of ECH appear to heat more effectively than those that do not. Velocity and temperature histories show that there are temporal characteristics corresponding to whether the plasma was or was not effectively heated.

25592 **Comment on "Plasma kinetic theory in action-angle variables" [Phys. Fluids 28, 3538 (1985)].** Cary, J.R.; Wong, H.V.; Mahajan, S.M. (Department of Astrophysical, Planetary, and Atmospheric Sciences and Department of Physics, University of Colorado, Boulder, Colorado 80309-0391). *Physics of Fluids;* **31**: No. 3, 706-707(Mar 1988).

Kaufman's formula [Phys. Fluids 15, 1063 (1972)] for the first-order distribution function obtained via the action-angle formalism is shown to be correct. The proof requires that it be noted that the transformation from canonical coordinates to physical variables has terms of all orders. Neglect of this fact has led to an incorrect formula for the linear susceptibility in previous work.

25593 **Effect of a strong-current ion ring on spheromak stability.** Litwin, C.; Sudan, R.N. (Department of Nuclear Engineering and Engineering Physics, University of Wisconsin, Madison, Wisconsin 53706). *Physics of Fluids;* **31**: No. 3, 423-425(Mar 1988).

The stability of a spheromak with an energetic ion ring, carrying a current comparable to the plasma current, to the tilt mode is considered. For small departures from sphericity a perturbative approach is applied to an appropriate energy principle in order to calculate the lowest nontrivial kinetic contribution of the ion ring. An analytic stability criterion is obtained. It is seen that the prolate configuration becomes more stable while the oblate one is less stable than in the absence of the ring. The prolomak becomes stable when the ring kinetic energy exceeds the magnetic energy within the separatrix.

25594 **Electromagnetic effects on parametric instabilities of Langmuir waves.** Akimoto, K. (Earth and Space Sciences Division and Applied Theoretical Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **31**: No. 3, 538-546(Mar 1988).

Electromagnetic effects on parametric instabilities of Langmuir waves in unmagnetized plasmas are investigated. A fully electromagnetic treatment of these instabilities removes discontinuities of frequencies that are found to be present in the wave vector space of the electrostatic dispersion equation. Furthermore, it was found that a pair of novel parametric instabilities of Langmuir pump waves emerge owing to the electromagnetic effects. Both of them excite electromagnetic plasma waves near the plasma frequency. One of them is the hybrid modulational instability, which is a four-wave up-conversion process. As the wave vector of the pump wave increases the hybrid parametric decay instability becomes dominant. This is a three-wave down-conversion instability, which has been investigated previously [Space Sci. Rev. 26, 3 (1980); Phys. Rev. A 27, 552 (1983); Astrophys. J. 308, 954 (1986)].

25595 **Electron diamagnetism and toroidal coupling of tearing modes.** Cowley, S.C.; Hastie, R.J. (Plasma Physics Laboratory, Princeton University, P. O. Box 451, Princeton, New Jersey 08544). *Physics of Fluids;* **31**: No. 3, 426-428(Mar 1988).

Using a simple model for the layer of the tearing mode, it is demonstrated that toroidally coupled tearing modes with two rational surfaces are most unstable when the ω^*'s of the electrons at the rational surfaces are equal. The onset of instability may then occur because of the tuning of ω^* rather than the passage of Δ'-like quantities through zero. This mechanism for the onset of instability is sharp since the resonance is narrow. The effect of toroidal rotation is also discussed.

25596 **Kinetic theory of electron drift vortex modes.** Jones, R.D. (University of California Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **31**: No. 3, 535-537(Mar 1988).

Magnetic electron drift vortex modes are examined using a kinetic theory. The dispersion is found to be much different than that obtained from the fluid theory. For frequencies much smaller than the electron plasma frequency, the waves are heavily Landau damped. The modes are weakly damped at frequencies just below the plasma frequency and hence have an electromagnetic rather than magnetic character.

25597 **Induced absorption of extraordinary (Z-mode) waves via electron pumping.** Borovsky, J.E. (Space Plasma Physics Group, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **31**: No. 3, 700-702(Mar 1988).

When induced by pitch-angle scattering, waves of the middle branch of the extraordinary mode will give up their energy to a plasma by magnetically pumping electrons. The damping decrement for small-amplitude extraordinary waves is calculated and the decrement for finite-amplitude waves is estimated. Because heating a plasma makes it a better absorber of extraordinary waves, such waves can produce localized hot cavities in plasmas. The evolution of electron distribution functions f(v) is examined and it is found that magnetic-pumping-mediated absorption leads to fproportionalv^{-3} tails.

25598 **Effect of parallel magnetic field gradients on absorption and mode conversion in the ion-cyclotron range of frequencies.** Smithe, D.; Colestock, P.; Kammash, T.; Kashuba, R. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544; University of Michigan, Ann Arbor, Michigan 48109; McDonnell Douglas Company, St. Louis, Missouri 63141). *Physical Review Letters;* **60**: No. 9, 801-804(29 Feb 1988). Contract AC02-76CH03073.

The nonlocal Vlasov-Maxwell dielectric response kernel, $K(r,r')$, is constructed by integration along particle orbits in a non-uniform magnetic field. The phase integrals comprising the usual plasma dispersion function are altered, and contain a parameter characterizing the parallel field gradient. We numerically solve a

1D integral wave equation, including a parallel field gradient, describing the propagation, mode conversion, and absorption physics. Significant changes in absorption are found for the small-k/sub parallel/ regime.

25599 **Spectra of Se XVI to Se XXIV observed in a tokamak plasma.** Sugar, J.; Kaufman, V.; Rowan, W.L. (National Bureau of Standards, Gaithersburg, Maryland 20899). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 2, 236-242(Feb 1988).

Selenium was injected into the plasma of the Texas Experimental Tokamak by laser ablation. Spectra of Se ions stripped to the n @m = 3 shell were observed photographically with a 2.2-m vacuum spectrograph. Classifications of 60 lines arising from K-like to Na-like ions were determined. A wavelength accuracy of @m≈0.010 ξA was obtained by calibration with internally generated Fe spectra.

25600 **Gas-puff Z pinches with strong axial magnetic fields.** Felber, F.S.; Wessel, F.J.; Wild, N.C.; Rahman, H.U.; Fisher, A.; Fowler, C.M.; Liberman, M.A.; Velikovich, A.L. (California Univ., Irvine (USA); Los Alamos National Lab., NM (USA); AN SSSR, Moscow. Inst. Fizicheskikh Problem). *Laser and Particle Beams;* **5**: No. pt.4, 699-706(Nov 1987).

Ultrahigh axial magnetic fields have been compressed and measured in a gas-puff Z pinch. A 0.5-MA, 2-cm-radius annular gas-puff Z pinch with a 3-minute repetition rate was imploded radially onto an axial seed field, causing the field to compress. Axial magnetic field compressions up to 180 and peak magnetic fields up to 1.6 MG were measured. Faraday rotation of an argon laser (515.4 nm) in a quartz fiber on axis was the principal magnetic field diagnostic. Other diagnostics included a nitrogen laser interferometer, x-ray diodes, and magnetic field probes. The magnetic field compression results are consistent with simple snowplow and self-similar analytic models, which are presented. The axial magnetic fields strongly affect the Z pinch dynamics. Even small axial fields help stabilize the pinches, some of which exhibit several stable radial bounces during a current pulse. The method of compressing axial fields in a gas-puff Z pinch is extrapolable to the order of 100 MG. Scaling laws are presented. Potential applications of ultrahigh axial fields in Z pinches are discussed for x-ray lasers, inertial confinement fusion, and collimated sources of gamma radiation.

25601 **Respond to the article: 'Another view of the control of the isotopic composition of initial DT plasmas in tokamaks'.** Doyle, B.L. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of Nuclear Materials;* **150**: No. 2, 246(Oct 1987).

25602 **Asymptotic approximation for the dispersion relation of a hot magnetized plasma.** Bravo-Ortega, A.; Swanson, D.G.; Glasser, A.H. (Auburn Univ., AL (USA). Dept. of Physics; Los Alamos National Lab., NM (USA)). *Journal of Plasma Physics;* **38**: No. pt.2, 275-286(Oct 1987).

An asymptotic expression for the dielectric tensor ϵ of a hot magnetized plasma is obtained employing the steepest descents method, via the transformation of the components of ϵ into their integral representation. The electrostatic Bernstein dispersion relation for oblique and perpendicular propagation is discussed under this treatment. It is shown that with this procedure the computation of the dispersion relation is up to 20 times faster when it is compared with the original expression, and the relative accuracy is usually as good as 0.1% for a typical case.

25603 **Application of fusion-related electron temperature and density diagnostics to plasmas of commercial interest.** Rasmussen, D.A. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 46-47 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—). Contract AC05-84OR21400.

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

The study of electron confinement in fusion research devices has led to the development of a host of sophisticated diagnostic equipment and techniques. Many of these techniques can be applied to the study of industrial plasmas. The emphasis of this paper is primarily on microwave and laser based diagnostic techniques. These techniques include microwave and laser interferometry, microwave thermal emission and laser Thomson scattering. This paper consists of two parts. Included in the first part is a brief review of state of the art electron density and temperature diagnostics in magnetic and inertial fusion confinement experiments. In addition, the first part reviews the early application of these techniques; applications where fusion plasma parameters more closely resembled those of present day industrial plasmas. The second part of the paper includes a discussion of the range of plasma parameters over which the techniques could be applied. The relative strengths and weaknesses of each diagnostic technique, for specific applications, are discussed.

25604 **Pulsed ionization chamber diagnostic studies of fissioning plasmas.** Ellis, W.H.; Choi, W.Y. (Dept. of Nuclear Engineering Sciences, Univ. of Florida, Gainesville, FL 32611). pp 67 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—).

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

The pulsed ionization chamber (PIC) plasma diagnostic technique is being applied to the study of the production and loss kinetics of nuclear seeded plasmas produced in a series of candidate fuel-gas/MHD working fluids. The study is part of an overall program underway at the University of Florida for determining the properties and characteristics of candidate materials for use with its AGCR/PGCR gas-core nuclear reactor/MHD space power concepts. The series of gases under study includes pure rare gases He, Ar, and Xe and molecular gas mixtures including fissionable UF/ sub 6/ and other fluorine containing gases. The objective of the investigation is the determination of experimental values for electrical conductivities and plasma production and loss coefficients as functions of gas pressure and temperature. Trends established for such characteristics, determined initially at lower pressures and temperatures, i.e., 10-20 atm, 900-1000 K, should allow their values to be extrapolated, with confidence, into higher, more difficult to attain pressure and temperature regimes. The results obtained thus far support a T/sup -9/2/ temperature dependence for the plasma loss coefficients for pure rare gases and a T/sup -3/2/ temperature dependence, respectively, for molecular mixtures thereof.

25605 **Progress in fusion technology in the U.S. magnetic fusion program.** Dowling, R.J.; Beard, D.S.; Haas, G.M.; Stone, P.M.; George, T.V. (Office of Fusion Energy, U.S. Dept. of Energy, Washington, DC). pp 45-60 of Fusion technology 1986. Elmsford, NY; Pergamon Books Inc. (1987). (CONF-860917—).

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

In this paper the authors discuss the major technological achievements that have taken place during the past few years in the U.S. magnetic fusion program which have contributed to the global efforts. The goal has been to establish the scientific and technological base required for fusion energy. To reach this goal the fusion R&D program is focused on four key technical issues: determine the optimum configuration of magnetic confinement systems; determine the properties of burning plasmas; develop materials for fusion systems; and establish the nuclear technology of fusion systems. The objective of the fusion technology efforts has been to develop advanced technologies and provide the necessary support for research of these four issues. This support is provided in a variety of areas such as: high vacuum technology, large magnetic field generation by superconducting and copper coils, high voltage and high current power supplies, electromagnetic wave and particle beam heating systems, plasma fueling, tritium breeding and handling, remote maintenance, energy recovery. The U.S. Fusion Technology Program provides major support or has the primary responsibility in each of the four key technical issues of fusion, as described in the Magnetic Fusion Program Plan of February 1985. This paper has summarized the Technology Program in terms of its activities and progress since the Proceedings of the SOFT Conference in 1984.

25606 **Measurements of transient sheaths and rf affected plasma potential.** Cho, M.H.; Hershkowitz, N.; Intrator, T. (Dept. of Nuclear Engineering and Engineering Physics, Univ. of Wisconsin-Madison). pp 122-123 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—).

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

Plasma potential and sheath structure play an important role in many industrial plasma applications. Recent advances in diagnostic techniques, such as laser induced fluorescence and optogalvanic effect, have expanded the understanding of the sheath phenomena in commercial devices, however; two dimensional and time dependent characteristics of those parameters are still poorly understood. The authors present the experimental measurements of the transient sheath near an electrode with sudden negative bias in a collisionless argon plasma. The sheath is found to start as a matrix sheath, then expands to have a greater extent than Child-Languir sheath, and finally contracts to Child-Langmuir sheath. RF effects are also measured in parallel plasma capacitor. The results show that, from DC up to 500 KHz, the plasma potential profiles vary significantly. To avoid rf related complications in plasma production a hot-filament discharge plasma in a multidipole device is used. Typical plasma parameters are n = 10/sup 8/ — 10/sup 9/ cm/sup -3/, T/sub ./ — 2 eV, T/sub i/ — 0.2 eV, P/sub o/ — 10/sup -4./Torr. Data are obtained using emissive probes with two different techniques--time resolved sampling and time averaged techniques. Scaling with different plasma parameters and boundary conditions are discussed. Data from 0.1 to 1 Torr rf glow discharge plasmas are also discussed.

25607 **Toroidal dc plasma discharge for materials processing.** Gahl, J.; Lowell, J.; Kristiansen, M.; Hagler, M.; Ishihara, O. (Dept. of Electrical Engineering, Texas Tech Univ., Lubbock, TX 79409-4439). pp 123 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—).

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

Currently, toroidal dc plasma devices for materials processing are being constructed at Texas Tech University. Attempts are being made to increase the electron temperature of such plasmas, while maintaining low ion temperatures. Increasing the electron temperature increases the total ionization of the plasma and hence accelerates ion deposition. Maintaining low ion temperature reduces ion thermal spread. In pursuit of high electron temperatures and low ion temperatures, the authors are investigating the effects of microwave injection into these plasmas. The use of dc toroidal plasmas may not be limited only to thin film deposition, but may have a variety of materials processing uses. For example, they intend to investigate the use of such plasmas as ion sources with potentially high ion current densities.

25608 **High-beta stability of tokamaks with energetic particles.** Rosenbluth, M.N.; Van Dam, J.W.; Tsai, S.T.; Barnes, D.C. *IFS Newsletter;* 3: No. 1, 2-3(Jan 1984).

The theory investigated the situation in which an anisotropic population of hot particles (ions or electrons, beam injected or rf heated) is mirror trapped on the unfavorable-curvature side of a standard tokamak. The magnetic drift frequency of these particles is assumed to be much larger than the typical interchange growth rate, but not drift reversed. In this limit, the linear stability of high-mode-number ideal magnetohydrodynamic ballooning modes can be obtained by numerical solution of an integro-differential equation that is derived from a lower bound to the low-frequency kinetic variational principle. For simplicity, a large-aspect-ratio, shifted-circle model equilibrium was adopted, in which the plasma beta is small but has a finite gradient localized in a thin radial layer. Although this analysis underestimates stability, the results still indicate that energetic particles trapped can stabilize ballooning modes for all α/sub c/ and shear values up to S = 0.9.

25609 **Evidence of discrete Alfven waves in a plasma column.** Brunel, F. *IFS Newsletter;* 3: No. 1, 4-6(Jan 1984).

Discrete or global Alfven wave fluctuations have been observed in a plasma column using a 3-dimensional MHD particle code. To observe the global Alfven wave, the MHD particle code is run with a thermal level of fluctuations. They use a stable equilibrium or one sufficiently stable to insure that the fastest instability grows in a time much longer than the characteristic time T of the duration of the run.

25610 **Transport in Hamiltonian systems.** Meiss, J.D. *IFS Newsletter;* 3: No. 1, 7-8(Jan 1984).

A new theory of transport which can be applied to the calculation of diffusion near the stochastic threshold has been developed. In this theory, attention is focused on the remnants of invariant surfaces which remain after destruction of the invariants by a perturbation. These remnants, called cantori, provide effective barriers for particle motion well above the breakdown level of perturbation. The theory is formulated in terms of the flux of trajectories through a cantorus. Near the breakdown the flux grows as the 3.01 power of the perturbation amplitude independent of the specific dynamics. Preliminary calculations on simple maps have verified the importance of the cantori as effective barriers in transport and the scaling of the transport times with the inverse of the theoretical flux.

25611 **Rotationally driven drift modes in the tandem mirror.** Horton, W.; Liu, J. *IFS Newsletter;* 3: No. 1, 9-12(Jan 1984).

Previous studies of the drift modes in axisymmetric model of the tandem mirror focused on the axial eigenvalue problem with density and temperature gradients driving instability and the angular rotation only accounting for the Doppler shift of the wave frequency to the laboratory frame. The angular rotation Omega of the plasma, however, introduces inertial forces not present in the static plasma. Both the coriolis force and the centrifugal force act preferentially on the ions producing charge separation that changes the low frequency dynamics of the plasma. This paper discussed the effects of these inertial forces on the stability and transport from drift modes in the tandem mirror.

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REFER ALSO TO CITATION(S) 24639, 24984, 25531, 25553, 25573, 25605, 25605, 25605

25612 **(CEA-CONF—9161) Recent progress in the design of Tore Supra.** Aymar, R.; Bon Mardion, A.; Deschamps, P.; Leloup, C.; Libeyre, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France)). Nov 1986. 5p. (CONF-861110—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752220/JAW.

From American Physical Society Plasma Physics Division meeting; Baltimore, MD, USA (3 Nov 1986).

Tore Supra is a large size, high field superconducting tokamak (Bo = 4.5 T; major radius = 2.25 m; plasma radius = 0.8 m; plasma current = 1.7MA; time discharge = 30 s). Its objectives are twofold: i) to gain experience with superconducting technology in a tokamak environment ii) to contribute to physics of additional heating, non inductive current drive, impurity control in hot dense quasi-steady plasma.

25613 **(CONF-871007—90) ALEX results: A comparison of measurements from a round and a rectangular duct with 3-D code predictions.** Reed, C.B.; Picologlou, B.F.; Hua, T.Q.; Walker, J.S. (Argonne National Lab., IL (USA); Illinois Univ., Urbana (USA). Dept. of Theoretical and Applied Mechanics). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02. Order Number DE88005947/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Recent results of liquid-metal magnetohydrodynamic (MHD) measurements from a rectangular duct and earlier measurements from a round duct are reported. A fully three-dimensional numerical analysis of each test section in the fringing region of an applied magnetic field is briefly described. The results of the experiments

and the 3-D code predictions are compared and discussed. Excellent agreement is obtained in both test section geometries for interaction parameters ranging from $500 \leqq N \leqq 1.25 \times 10^5$. 9 refs., 7 figs., 1 tab.

25614 (CONF-880166—2-Vugraphs) Task Group 11, Configuration. Lousteau, D.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03. Order Number DE88006187/JAW.

From ITER review meeting; Princeton, NJ, USA (19 Jan 1988).

This paper contains viewgraphs on the magnetic assembly of divertors for the ITER tokamak. The paper discusses the removal for maintenance of the divertors. (LSP)

25615 (CONF-8709241—1-Vugraphs) Initial results of systems analysis of the ITER design space. Peng, Y.K.M.; Galambos, J.D.; Reid, R.L.; Strickler, D.J.; Kalsi, S.S.; Deleanu, L. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006189/JAW.

From ITER systems code and analysis meeting; Oak Ridge, TN, USA (30 Sep 1987).

This series of vugraphs presents preliminary analyses of various design points for the next generation thermonuclear test reactor. The authors state that constrained optimization of a figure-of-merit leads to acceptable design points. Design points discussed include: device radius, aspect ratio, magnetic field strength, magnet current, plasma current, and ignition margin. (JDH)

25616 (DOE/ER/52121—T1) Outlook for the fusion hybrid and tritium-breeding fusion reactors. Richardson, J.M.; Cohen, R. (eds.). (National Research Council, Washington, DC (USA). Committee on Fusion Hybrid Reactors). 1987. Contract FG05-85ER52121. 170p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88005789/JAW.

It is possible to use a nuclear fusion reactor, of a somewhat less technologically challenging design than that contemplated purely for the generation of electricity, by employing fusion-derived neutrons to drive useful nuclear reactions. One device based on this concept is called the fusion hybrid reactor, or, perhaps more explicitly, the fusion-fission hybrid reactor. Neutrons from a fusion core would react with fertile and fissible material in a blanket surrounding the core, with the consequent creation of both fissile material for conventional nuclear reactor fuel and heat for generating electricity. Another such device, called the tritium-breeding fusion reactor, would breed tritium by reaction with lithium targets around the core. This report examines future circumstances in which these reactors might be needed and advantageous. Based on their technical, economic, and social aspects, it discusses the program content and pace at which these applications ought to be pursued. 46 refs., 35 figs., 31 tabs.

25617 (DOE/ER/53198—117) Electrical circuit modeling of reversed field pinches. Sprott, J.C. (Wisconsin Univ., Madison (USA). Dept. of Physics). Feb 1988. Contract FG02-85ER53198. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006942/JAW.

Equations are proposed to describe the radial variation of the magnetic field and current density in a circular, cylindrical RFP. These equations are used to derive the electrical circuit parameters (inductance, resistance, and coupling coefficient) for an RFP discharge. The circuit parameters are used to evaluate the flux and energy consumption for various startup modes and for steady-state operation using oscillating field current drive. The results are applied to the MST device. 32 refs., 14 figs., 1 tab.

25618 (DOE/ET/51013—234) DT and DHe^3 tokamak test reactor concepts using advanced, high field superconductors. Cohn, D.R.; Schwartz, J.; Bieri, R.L.; Bromberg, L.; Williams, J.E.C. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 14 Oct 1987. Contract AC02-78ET51013. 14p. (PFC/CP—87-15; CONF-871007—89). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006260/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

If practical high temperature superconducting ceramic magnets can be developed, there could be a significant impact on reactor design. Potential advantages include a simpler, more robust magnet design, the possibility of demountable superconducting toroidal field coils and reduced shielding requirements. The high temperature superconductors can also have very high critical fields and could provide super high field operation. This could substantially increase eta tau/sub E/ values, reduce β requirements, and improve prospects for ohmic heating to ignition. The combination of moderately high β and super high field could make DHe^3 operation possible in a JET size tokamak. In this paper we discuss possibilities for test reactor designs using high temperature high field superconductors. An illustrative design has a field at the plasma of 15 T. This reduces the required β to less than 2% for DT operation. The required plasma current is 5 MA. For a reactor size of $R_0 = 3.4$m and $a = 0.6$m, the neutron wall loading is 3.3 MW/m^2 at $\beta = 1.5\%$ for DT operation and an equal amount of fusion power is produced at $\beta = 10\%$ for DHe^3 operation. One possible mode of operation is to use ohmic heating to ignition in a DT plasma followed by thermal runaway to DHe^3 temperatures. 7 refs., 1 fig., 2 tabs.

25619 (EGG-FSP—7922) 1988 failure rate screening data for fusion reliability and risk analysis. Cadwallader, L.C.; Piet, S.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1988. Contract AC07-76ID01570. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88006798/JAW.

This document contains failure rate screening data for application to fusion components. The screening values are generally fission or aerospace industry failure rate estimates that can be extrapolated for use by fusion system designers, reliability engineers and risk analysts. Failure rate estimates for tritium-bearing systems, liquid metal-cooled systems, gas-cooled systems, water-cooled systems and containment systems are given. Preliminary system availability estimates and selected initiating event frequency estimates are presented. This first edition document is valuable to design and safety analysis for the Compact Ignition Tokamak and the International Thermonuclear Experimental Reactor. 20 refs., 28 tabs.

25620 (EGG-FSP—7961) ATHENA [Advanced Thermal-Hydraulic Energy Network Analyzer] transient analysis of a fusion engineering test reactor. Wareing, T.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006799/JAW.

Two potential undercooling transients are of concern in the design of TIBER-II (Tokamak Ignition/Burn Experimental Reactor), namely loss of coolant and loss of flow accidents. The major area of concern for TIBER-II is the inboard shield, where, due to tungsten material, the decay heat is extremely high. The purpose of this study was to analyze these transients using the thermal-hydraulic code ATHENA (Advanced Thermal-Hydraulic Energy Network Analyzer). The most comprehensive portion of this project involved creating a simple, yet complete, ATHENA model representative of TIBER-II. The completed model represents the case when the plasma is off and contains the inboard shield, the outboard shield, the divertor shields, and the primary loop. The primary loop contains the piping, pump, pressurizer, and heat exchanger. The heat exchanger is at the same elevation as the reactor, the least favorable to establishing natural circulation. The only transient analyzed so far, however, is a loss of flow accident. Results from the loss of flow analysis show that there is sufficient natural circulation in the inboard, outboard, and lower divertor shield to remove the decay heat, assuming that the secondary side flow is at full capacity. Although the upper divertor shield does not have sufficient natural circulation, cooling is provided due to vaporization and re-flood oscillations. However, one must recognize that there may be some local hot sport where the flow geometry inhibits cooling in a LOFA; the ATHENA model would not detect any localized problem. 9 refs., 18 figs., 4 tabs.

25621 **(EGG-M—33387) Environmental assessment for the compact ignition tokamak.** McKenzie-Carter, M.A.; Stencel, J.R. (EG and G Idaho, Inc., Idaho Falls (USA); Princeton Univ., NJ (USA). Plasma Physics Lab.). 1987. Contract AC07-76ID01570. 4p. (CONF-871007—86). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005633/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The Compact Ignition Tokamak (CIT) is the proposed next step in the US magnetic confinement fusion energy program. The US Department of Energy (DOE) has chosen the Princeton Plasma Physics Laboratory (PPPL) as the preferred location for this ignition research device. The specific proposed site at PPPL is adjacent to the existing Tokamak Fusion Test Reactor (TFTR) test cell. One of the necessary early planning steps in the schedule for the project is compliance with the National Environmental Policy Act (NEPA). Projected environmental impacts of the CIT are minimal. The only unique nonradiological environmental aspect to the project will be releases of relatively large but innocuous amounts of nitrogen gas, as a result of passive liquid nitrogen cooling of the machine. Consequently, potential radiological impacts are of greatest interest. Estimates of releases of tritium and air activation products from the CIT, which may use up to 20 grams of tritium, have been made and consequential doses have been calculated. These preliminary dose calculations indicate that the routine operation design objective dose of 10 mrem/year to the maximally exposed member of the public will be met. Potential accident scenarios have also been developed and the potential effects summarized.

25622 **(ENEA-RT-FUS—87-18) Modal analysis of a stiffened toroidal shell sector.** Cerreta, R.; Di Pietro, E.; Pizzuto, A. (ENEA, Rome (Italy)). 1987. 15p. (CONF-8709250—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88701559/JAW.

From Internatiónal workshop on structural dynamic modeling techniques; Louvain, Belgium (23 Sep 1987).

This paper presents the results of the modal analysis of a sector of the toroidal vacuum vessel of a new experimental machine for research in the field of controlled thermonuclear fusion (FTU - Frascati Tokamak Upgrade). The vacuum vessel, one of the most critical components of the experimental device, consist of 12 stainless steel toroidal sectors, and it is designed to withstand pulsed electromagnetic loads during operation. Results of the modal analysis of the stiffened toroidal shell sector are compared and discussed with regard to the experimental data. Theoretical eigenvalues and eigenvectors have been predicted by means of ABAQUS finite element code. Experimental analysis has been carried out on a full scale model and natural frequencies have been measured. Satisfactory agreement between experimental and theoretical eigenvalues has been found.

25623 **(ENEA-RT-FUS—87-24) Confinement and burnup of fusion produced tritons in the FT TOKAMAK.** Batistoni, P.; Haegi, M.; Bittoni, E. (ENEA, Frascati (Italy). Centro Ricerche Energia; ENEA, Bologna (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701802/JAW.

An improved triton burn-up code, using the shot to shot measured plasma parameters and profiles, is used to predict the 14 MeV to 2.5 MeV neutron fluence ratio under the assumption of classical slowing down. This neutron fluence ratio is copared with the experimental fluence ratio from the FT tokamak for various toroidal magnetic fields and plasma currents. Assuming a current distribution J(r)~T/sub e(sup 3)//2, it is found that for q(a)>3, the confinement is classical, within the error bars, but for q(a)<3, the confinement seems progressively to deteriorate with increasing MHD activity. Assuming on the contrary the Kadomtsev sawtooth model for the current distribution, such deterioration does not seem to occur. 17 refs.

25624 **(GA-A—19139) Neutral Beam Long Pulse Project: Final report for the period FY86 through FY87.** Colleraine, A. (GA Technologies, Inc., San Diego, CA (USA)). Jan 1988. Contract AC03-84ER51044. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006973/JAW.

This paper discusses the modification of systems, the project costs, and the project schedule of the long pulse neutral beam source at GA Technologies. 1 fig., 5 tabs. (LSP)

25625 **(IC—87/145) Thermal inhibition by megagauss field due to variation of electron temperature in laser plasma.** Jha, L.N. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701887/JAW.

The magnetic field evolution equation is solved by the Transform method and the variation of megagauss fields due to perturbation in temperature has been shown. The influence of B/sub max/-variation on ICF target due to thermal inhibition has also been discussed. (author). 11 refs, 2 figs.

25626 **(ILE—8701P) Ultra-high pulsed magnetic field produced by CO/sub 2/ laser.** Daido, H.; Mima, K.; Miki, F.; Fujita, M.; Kitagawa, Y.; Nakai, S.; Yamanaka, C. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). Jan 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752320/JAW.

Presented is the method of generating high magnetic field driven by a CO/sub 2/ laser. The magnetic field, current and voltage in a one-turn coil are measured as the functions of the gap width where the high voltage is induced by the laser irradiation at a fixed intensity of 1.3 x 10/sup 14/ W/cm/sup 2/. Those results are explained on the basis of lateral transport by hot electron E x B motion and the expansion of the critical density plasma in the gap. The maximum magnetic field are determined and limited by the filling time of the gap with critical-density plasma. In order to get higher magnetic field, we test the cylinder type one-turn coil attached to the optimized gap. Highest magnetic field of 400 T was observed.

25627 **(IPP—2/286) Progress in stellarator/heliotron research: 1981-1986. Executive summary.** Carreras, B.A.; Grieger, G.; Harris, J.H.; Johnson, J.L.; Lyon, J.F.; Motojima, O.; Rau, F.; Renner, H.; Rome, J.A.; Uo, K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1987. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88752046/JAW.

This report is the first of two volumes - an executive summary and a full report - that document progress in stellarator/heliotron research in the five years (1981-1986) since a previous U.S.-EURATOM assessment of stellarator research. The present study was carried out under the terms of the IEA Implementing Agreement for Cooperation in Development of the Stellarator Concept by researchers from the Kyoto University Plasma Physics Laboratory in Japan, the Max-Planck-Institut fuer Plasmaphysik in the Federal Republic of Germany and the Oak Ridge National Laboratory and the Princeton Plasma Physics Laboratory in the United States of America. This executive summary is being published as ORNL/TM-10482 by the Oak Ridge National Laboratory, as IPP-2/286 by the Max-Planck-Institut fuer Plasmaphysik, and as PPLK-7 by the Kyoto University Plasma Physics Laboratory. The full report will be published as ORNL/TM-10483, IPP-2/287, and PPLK-8. The eight numbered sections of the executive summary correspond to the first eight chapters of the full report. An introduction to the topic is followed by an assessment of the existing data base, a discussion of the information expected from the present generation of experiments, and brief reviews of facilities needed in the future, engineering issues, and reactor considerations. The executive summary concludes with a statement of the essential ideas presented in this document and in the full report.

25628 **(IPPJ—847) Microstructural change of Al on H implantation.** Kamada, K.; Sagara, A.; Kinoshita, H.; Takahashi, H. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Sep 1987. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752334/JAW.

Modifications to the subsurface layer of Al on 25 keV H/sub 2//sup +/ ion implantation to fluences of 4 x 10/sup 17/ to 2 x 10/sup 18/ H/sup +//cm/sup 2/ at room temperature were investigated by transmission electron microscopy (TEM) and elastic recoil detection (ERD) with 1.5 MeV He/sup +/. Numerous bub-

bles ranging in diameter from 50 A to 1000 A were observed with a sharp peak at 120 A irrespective of the ion fluence. Stereomicroscopic observations revealed the depth distribution of the bubbles. At fluences greater than 6 x 10/sup 17/ H/sup +//cm/sup 2/, a lateral layer of lower density compared with matrix was observed and named "Swiss cheese structure" since its estimated structure is similar to Emmenthal chseese containing many holes. This "Swiss cheese structure" causes the formation of new layers on a free surface, and plays a precursor role for blistering. Hydrogen depth profiling with ERD was performed on every specimen revealing the collapse of the implanted hydrogen profile due to the formation of the "Swiss cheese structure".

25629 **(ITEF—141(1987)) Rayleigh-Taylor instability in heavy ion fusion multishell targets.** Neudachin, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701942/JAW.

Development of Rayleigh-Taylor instability in heavy ion fusion targets is considered. The nonlinear stage of instability development, factors decreasing instability increment such as a finite density gradient, ablation, turbulent mixing of boundary a.o. are analysed. Permissible initial target roughness, eta, is estimated. A calculational procedure of permissible initial roughness in one-dimensional calculations is suggested. It is shown that the account of these factors increases value eta by two orders if comparing with a spread exponential estimation. Ways of target instability decrease are discussed. 16 refs.; 2 figs.

25630 (JAERI-M—86-080, pp 86-101) **Sensitivity theory for inertial confinement pellet fusion system.** Cai, Sbaohui; Zhang, Yuquan. (China Nuclear Data Center, Beijing, China. Inst. of Atomic Energy; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE86901587/JAW. (NEANDC(J)—120/U; INDC(JPN)—106/L; CONF-8511220—).

From Seminar on nuclear data; Tokai, Japan (12 Nov 1985).

A sensitivity theory for inertial confinement pellet fusion system is developed based on a physical model similar to that embodied in the laser fusion code MEDUSA. The theory presented here can be an efficient tool for estimating the effects of many alternations in the data field. Our result is different from Greenspan's work in 1980.

25631 **(JAERI-M—87-120) Development of tokamak reactor conceptual design code 'TRESCODE'. Conceptual design study of FY86 FER.** Mizoguchi, Tadanori; Sugihara, Masayoshi; Shinya, Kichiro. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752344/JAW.

Tokamak reactor system conceptual design code (TRESCODE) is developed on the basis of FER design studies. The code can be applied to the scoping studies for various reactor concepts. In this objects, relative cost estimations in terms of volume/weight and input/output energy can be carried out under the design driver/constraints of physics and engineering. Cost effective reactor concept is to be selected in this process. The code can also be used for engineering design of tokamak core structure for the selected reactor concept. In this objects, accurate radial-build and vertical-build based on shield calculation and stress/strain analysis of magnet system can be carried out under the design constraints/conditions. Operation scenario is included with plasma equilibrium and poloidal field calculations to obtain the desired reactor concept.

25632 **(JAERI-M—87-139) Conceptual design study of fusion experimental reactor (FY86 FER). Reactor configuration/structure design.** Kobayashi, Takeshi; Yamada, Masao; Mizoguchi, Tadanori. (Japan Atomic Energy Research Inst., Tokyo). Sep 1987. 365p. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88752326/JAW.

This report describes the results of the reactor configuration/structure design for the fusion experimental reactor (FER) performed in FY 1986. The design was intended to meet the physical and engineering mission of the next step device which was decided by the subcommittee on the next step device of the nuclear fusion council. The objectives of the design study in FY 1986 are to advance and optimize the design concept of the last year because the recommendation of the subcommittee was basically the same as the design philosophy of the last year. Six candidate reactor configurations which correspond to options C ~ D presented by the subcommittee were extensively examined. Consequently, ACS reactor (Advanced Option-C with Single Null Divertor) was selected as the reference configuration from viewpoints of technical risks and cost performance. Regarding the reactor structure, the following items were investigated intensively: minimization of reactor size, protection of first wall against plasma disruption, simplification of shield structure, reactor configuration which enables optimum arrangement of poloidal field coils.

25633 **(JAERI-M—87-154) Conceptual design study of fusion experimental reactor (FY86 FER). RF heating and current drive system design.** Nakashima, Kunihiko; Okano, Kunihiko; Miyamoto, Kazuhiro. (Japan Atomic Energy Research Inst., Tokyo). Sep 1987. 110p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88752328/JAW.

This report describes the results of a conceptual study on the RF system in the typical candidates for the Fusion Experimental Reactor (FER), which were picked out through the '86FER scoping studies. According to the FER operation scenario, three RF systems, that is, ICRF (heating), LHRF (current drive and heating), ECRF (auxiliary heating) were studied. Main concern in these RF systems is the launcher, which may be so designed that required power match the geometrical constraints of the reactor. Then studies were concentrated on the launcher configuration. A prug-in concept of the launcher was adopted in each system and vacancies except transmission space were filled with water. The ICRF launcher had the 2 x 2 loop arrays antenna and the faraday shield area of 1.5 m x 1 m to provide a power of 20 MW. The LHRF launcher had the grillantenna with 28 x 8 open waveguides, and included multi junction-type power splitters which were connected to 56 transmission wave guides. The grild was designed to have two functions of current drive and heating, and provide a power of 20 MW each. The ECRF launcher had a boundle of open wave guides which a reflection mirror each, and three plain mirrors. Assuming a oscillator unit size of 200 kW, it had 40 oversized wave guides to provide a power of 3 MW.

25634 **(JAERI-M—87-182) Investigation on calculation method of decay gamma ray streaming through void gap in activated shield of fusion reactor.** Mori, Seiji; Kobayashi, Takeshi; Seki, Yasushi. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 60p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88752343/JAW.

There exist many void gaps (slits) in structure components of a tokamak fusion reactor, and decay gamma ray from induced activity will cause radiation streaming through these gaps even after reactor shutdown. At the initial phase of design, therefore, it is required to estimate the streaming effect roughly and to consider means to reduce the effect. In this study, first, dependency of gamma ray streaming effect on gap width and length under some fixed conditions of volumetric distributed source were investigated and results were summarized in the form of figures and tables. Next, distributions of induced activity and decay gamma ray source was investigated and results were summarized in the form of figures were examined both for bulk shield and shield with a gap. Finally, approximate method to estimate the gap streaming effect was proposed using these calculated results. It was found that this method gives result with sufficient accuracy for engineering use by comparing the estimated values by the approximate method with the detailed analysis by computer.

25635 **(JAERI-M—87-183) Development of the methan glow discharge system on JT-60.** Kawasaki, Kozou; Hiratsuka, Hajime; Miyo, Yasuhiko; Kuroda, Takeshi; Ohta, Kazuya; Maeno, Masaki; Ohkubo, Minoru. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 20p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752341/JAW.

Methan glow discharge system on JT-60 was developed to coat carbon on the surface of the first wall. The objective of this system is to produce the carbon coating on the surface of the first wall and to make the glow discharge for the treatment of the first wall. This system was completed January 1986, and has been operated twenty-two hours for the conditioning of the first wall after the graphite first wall had attached in the JT-60 vacuum chamber. The glow discharge test result with this system are as followes, (1) GDC is usefull to remove the hydro-carbon, especially the reduction of M/e = 16, 28 is observed after GDC operation. (2) Reduction of the M/e = 16, 28 is increazing the discharge current and discharge pressure. (3) The comparison of the GDC effect of JT-60 with that of TFTR shows that no difference is found in the reduction rate of M/e = 16, 28.

25636 **(KFK—4287) Thermomechanical analysis of different first wall designs for the helium cooled pebble bed canister blanket for NET.** Sordon, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion). Aug 1987. 46p. (EUR—10537e). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88752016/JAW.

A 2-D thermomechanical analysis of He-cooled first wall designs with radiatively cooled protection tiles was performed with the FE-code ABAQUS. These designs were suggested for the KfK-NET blanket concept with ceramic breeder material. The calculated temperature distributions for the tiles and for the underlying steel structure are reported. In addition the stress distributions for the steel structure are presented. All calculations were performed for steady state conditions. The results show that a helium cooled first wall for heat fluxes up to 40 W/cm/sup 2/ seems feasible.

25637 **(UCID—20981-Vol.1) TMX-U [Tandem Mirror Experiment-Upgrade]: Final report, Volume 1.** Porter, G.D. (ed.). (Lawrence Livermore National Lab., CA (USA)). 1 Feb 1988. Contract W-7405-ENG-48. 398p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE88006999/JAW.

This paper discusses the plasma control and the physics accomplishments of the Tandem Mirror Experiment-Upgrade. This particular volume discusses potential measurements, plasma confinement, and hot electron and ion physics. 230 refs. (LSP)

25638 **(UCID—20981-Vol.2) TMX-U [Tandem Mirror Experiment-Upgrade]: Final report, Volume 2.** Porter, G.D. (ed.). (Lawrence Livermore National Lab., CA (USA)). 1 Feb 1988. Contract W-7405-ENG-48. 472p. NTIS, PC A20/MF A01; 1; GPO Dep. Order Number DE88007004/JAW.

This paper discusses the plasma control and the physics accomplishments of the Tandem Mirror Experiment-Upgrade. This particular volume discusses fueling, ion heating, Fokker-Planck modeling, plasma stability and technical development. 270 refs. (LSP)

25639 **(UCLA/PPG—1125) Magnetic Fusion Energy Plasma Interactive and High Heat Flux Components: Volume 5, Technical assessment of critical issues in the steady state operation of fusion confinement devices.** (California Univ., Los Angeles (USA). Inst. for Plasma and Fusion Research). Jan 1988. Contract FG03-85ER51069. 201p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88006920/JAW.

Critical issues for the steady state operation of plasma confinement devices exist in both the physics and technology fields of fusion research. Due to the wide range and number of these issues, this technical assessment has focused on the crucial issues associated with the plasma physics and the plasma interactive components. The document provides information on the problem areas that affect the design and operation of a steady state ETR or ITER type confinement device. It discusses both tokamaks and alternative concepts, and provides a survey of existing and planned confinement machines and laboratory facilities that can address the identified issues. A universal definition of steady state operation is difficult to obtain. From a physics point of view, steady state is generally achieved when the time derivatives approach zero and the operation time greatly exceeds the characteristic time constants of the device. Steady state operation for materials depends on whether thermal stress, creep, fatigue, radiation damage, or power removal are being discussed. For erosion issues, the fluence and availability of the machine for continuous operation are important, assuming that transient events such as disruptions do not limit the component lifetimes. The panel suggests, in general terms, that steady state requires plasma operation from 100 to 1000 seconds and an availability of more than a few percent, which is similar to the expectations for an ETR type device. The assessment of critical issues for steady state operation is divided into four sections: physics issues; technology issues; issues in alternative concepts; and devices and laboratory facilities that can address these problems.

25640 **(UCRL—97703) Demonstration of efficient full aperture Type I/Type II third harmonic conversion on Nova.** Wegner, P.J.; Henesian, M.A.; Marchi, F.T.; Speck, D.R. (Lawrence Livermore National Lab., CA (USA)). 19 Nov 1987. Contract W-7405-ENG-48. 7p. (CONF-880402—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003834/JAW.

From CLEO '88: OSA/IEEE conference on lasers and electro-optics; Anaheim, CA, USA (25 Apr 1988).

Type I/Type II third harmonic conversion has been implemented at the 74 cm aperture of the Nova laser system. We discuss the performance capabilities and alignment issues of this scheme for Nova relative to conventional Type II/Type II conversion. 3 refs., 2 figs.

25641 **(UCRL—97704) Performance of a Nova beamline with high damage threshold glass.** Bibeau, C.; Ehrlich, R.B.; Lawson, J.K.; Laumann, C.W.; Pennington, D.M.; Weiland, T.L.; Henesian, M.A.; Speck, D.R. (Lawrence Livermore National Lab., CA (USA)). 19 Nov 1987. Contract W-7405-ENG-48. 5p. (CONF-880402—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003295/JAW.

From CLEO '88: OSA/IEEE conference on lasers and electro-optics; Anaheim, CA, USA (25 Apr 1988).

We report on measurements made on a Nova beamline whose output amplifier stages contain new high damage threshold, platinum particle-free laser glass. We project future operating limits for the Nova ten beam amplifier system. 4 refs.

25642 **(UCRL—97711) Observation of anomalous low J-value Stokes and anti-Stokes lines in stimulated rotational Raman scattering over long air paths.** Pennington, D.M.; Henesian, M.A. (Lawrence Livermore National Lab., CA (USA)). 20 Nov 1987. Contract W-7405-ENG-48. 8p. (CONF-880402—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003756/JAW.

From CLEO '88: OSA/IEEE conference on lasers and electro-optics; Anaheim, CA, USA (25 Apr 1988).

Anomalous low-J-value Stokes and anti-Stokes lines in stimulated rotational Raman scattering are observed with large Fresnel number, linearly polarized beams. Forced light scattering at the rotational intermodulation frequency is also observed. Dynamics of the Stokes-anti-Stokes coupling will be discussed. 5 refs., 2 figs.

25643 **Proposal for a sensitive leak test telescope.** Blanchard, W.R.; Hemmerich, J.L.; Winkel, T.; Reiter, D. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* 6: No. 2, 235-237(Mar 1988). Contract AC02-76CH03073.

A proposal for an in-vessel movable leak sensor, called a leak test telescope, is described for leak localization inside two of the largest thermonuclear fusion devices (TFTR and JET). To improve sensitivity and source identification beyond the present state of the art, a differential sensor head employing two actively pumping collimators, a continuously rotating shutter, and a quadrupole

mass spectrometer as sensor is proposed. With the use of phase-lock signal processing this detector should be capable of detecting a leak of 1 x 10^{-6} Torr l/s from a distance of 0.5 m in a typical fusion environment with backgrounds >1 x 10^{-7} Torr deuterium—tritium.

25644 Results of the AFWL deflagration gun experiments. Hackett, K.E.; Baker, W.L.; Beason, J.D.; Clouse, C.J.; Degnan, J.H.; Dietz, D.; Hall, D.J.; Higgins, P.L.; Holmes, J.L.; McCullough, W.F. (Air Force Weapons Lab., Advanced Weapons Office, Plasma Physics Branch, Kirtland AFB, NM 87117-6008). pp 119 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—).

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

The snowplow and deflagration modes of coaxial plasma gun operation have been experimentally investigated and computationally simulated at the Air Force Weapons Laboratory. The snowplow mode occurs when the gun is prefilled to a uniform gas density. The initial breakdown forms near the insulator at the gun breech. It heats the gas and creates a shock wave that travels down the gun, ionizing gas and producing a thin current sheath that travels just behind the shock front. The shock front piles up the gas in front of itself as it moves down the gun - hence the name "snowplow". Deflagration occurs when gas is injected into an evacuated gun so that the initial breakdown forms as the gas fills the gun. The ionized gas is accelerated into the vacuum region carrying current and magnetic field with it. A quasi-stationary diffuse discharge develops. Gas still entering the gun is processed through the deflagrating discharge and accelerated out the gun muzzle.

25645 Electron beam induced enhancement of gaseous combustion reactions. Gilgenbach, R.M.; Bidwell, S.W.; Bosch, R.A.; Brake, M.L.; Tucker, J.E.; Repetti, T. (Intense Energy Beam Interaction Lab., Nuclear Engineering Dept., The Univ. of Michigan, Ann Arbor, MI 48109-2104). pp 124 of The 1987 IEEE international conference on plasma science (Abstracts). Piscataway, NJ; IEEE Service Center (1987). (CONF-870651—).

From IEEE international conference on plasma science; Crystal City, VA, USA (1 Jun 1987).

Results are reported of the first experiment in which high current electron beam injection has been demonstrated to significantly modify the combustion reaction in both lean and rich fuel-air mixtures. The experiment is performed by injecting a 400 kV, 1 kA, 400 ns electron beam through a 0.025 mm titanium foil and 40% transparent anode screen into an atmospheric pressure mixture of ethylene (C/sub 2/H/sub 4/) and air. The mixture is preignited by a spark plug, with typical spark to beam delay of about 1 ms, although larger delays have been employed to test the time dependence of the effects. In the case of electron beam injection into lean or rich fuel-air mixtures, the pressure rise is a factor of 2 more rapid than with the spark alone.

25646 Summary abstract: radio frequency ion source development for neutral beam applications. Leung, K.N.; Ehlers, K.W.; Kippenhan, D.; Vella, M.C. (Lawrence Berkeley Lab., CA). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* 2: No. 2, 675(Apr-Jun 1984). Contract AC03-76SF00098.

At Lawrence Berkeley Laboratory, a 24 x 24 cm^2 rf source has been tested with beam acceleration. Recently, they have been investigating the characteristics of plasmas generated with different kinds of antenna coatings. The antenna coil was installed inside a cylindrical multicusp source (20 cm diameter by 24 cm long) and was driven by a 500 W amplifier. A tiny light bulb filament was used to start a background plasma. The rf was then switched on and a steady-state hydrogen plasma of moderate density ($n \approx 10^{11}$/cm^3) could be sustained even with the filament turned off.

99 GENERAL AND MISCELLANEOUS

25647 (DOE/S—0060) US-Canada Free-Trade Agreement. (USDOE Office of the Deputy Secretary, Washington, DC). Feb 1988. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006946/JAW.

The US-Canada Free Trade Agreement is an historic agreement that will yield major benefits for the US and Canadian economies, for US-Canadian bilateral trade relations, and for the international trade regime. The energy section of the Agreement is one of its most important. Energy trade between the US and Canada amounts to over $10 billion per year, the largest such bilateral trade in the world. Canada is our largest oil supplier and provides virtually all of our natural gas and electricity imports. While these volumes are a small fraction of US needs, they provide an important margin of energy security. Canada also is an important market for US energy exports, buying 16 million tons or $700 million worth of coal in 1987, 20% of US coal exports. The Free Trade Agreement ensures that the US and Canada can continued to enjoy unrestricted trade in energy, provides benefits to US consumers and producers, and enhances our energy security. The Agreement: prohibits future restrictions on energy trade, such as quantitative restriction, import or export taxes, and minimum prices; ensures that US consumers will be treated equitably with Canadian consumers; provides added assurance of supply in the event of disruptions; will lower costs to consumers, including our energy intensive industries, and help make US industry more competitive in world markets; will provide more certainty to producers and consumers, which should expand energy trade and be more conducive to energy investment; and will, over time, reduce US oil imports by encouraging continued market penetration of Canadian and US natural gas, and greater use of Canadian hydroelectric power.

25648 (SAND—87-1343-Vol.11-No.2) Sandia technology: Volume 11, No. 2. Thornbrough, D.; Butcher, B.; Calek, J.; Merritt, M.; Rix, D. (eds.). (Sandia National Labs., Albuquerque, NM (USA)). Dec 1987. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005955/JAW.

Five articles are included: optical-fiber communication network, control of GTA welding, electroforming, welding science, and seismic array in Norway. They are processed separately for the database. (DLC)

9901 Management

REFER ALSO TO CITATION(S) 24201, 24419, 24420

25649 (DOE/MA—0331) Department of Energy audit resolution, followup and internal control review activity: Quarterly management report as of December 31, 1987. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Audit Liaison Div.). Mar 1988. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006940/JAW.

This report provides information to the Department of Energy (DOE) management on the status of audit followup, General Accounting Office (GAO), Inspector General (IG) and internal control system activity for the quarter ended December 31, 1987. It is based on information accumulated and maintained by the Audit Liaison Division of the Controller's Office pursuant to DOE 2300.1A (draft 8/83) (Audit Compliance and Followup), 2340.1B (Coordination of General Accounting Office Activities), 2320.2 (Establishment of Departmental Position on Inspector General Reports) and 1000.3A (Internal Control Systems).

25650 (EMR/ERL—87/48(TR)) [Energy Research Laboratories] annual report 1986-1987. Harcourt, J.L. (comp.). (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). May 1987. 141p. (MICROLOG—87-05187). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

One of the principal objectives of CANMET's Energy Research Program is to develop the technologies required to conserve and to increase the supply of liquid fossil fuels in Canada to bridge the gap between domestic supply and demand. The Energy Research Laboratories (ERL) responds to this R&D objective on matters related to the upgrading of oil sands, heavy oil and synthetic crude production; coal/bitumen coprocessing; and improved oil and gas domestic heating furnaces. Another major objective is to develop new technologies to burn fossil fuels, mainly coal, under environmentally acceptable conditions and ERL responds to this objecive through research in the areas of coal combustion and gasification. Important input and guidance on project selection and implementation is provided by industry advisory committees and user groups. This report summarizes the activities of ERL during fiscal year 1986/87. It was decided in 1986 to realign the division's laboratories. A new laboratory, the Fuels Characterization Research Laboratory (FCRL) was created and includes the two analytical groups from the former Hydrocarbon Processing Research Laboratory (HPRL) and the Synthetic Fuels Research Laboratory (SFRL). HPRL's catalysis and separation groups have joined SFRL, and HPRL's coal gasification group is now part of the Combustion and Carbonization Research Laboratory.

25651 **(IAEA-TECDOC—438) International Laboratory of Marine Radioactivity: Biennial report 1985-1986.** (International Atomic Energy Agency, Vienna (Austria)). Oct 1987. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701819/JAW.

A review of the scientific activities of the ILMR in 1985-1986 is presented. The scientific programs of the Radiobiology Laboratory, Radiochemistry-Geochemistry Laboratory and Marine Environmental Studies Laboratory are briefly described. In addition lists of the visiting consultants/experts, trainees/fellows, publications/meetings, Committee/Expert group membership, courses and research/technical contracts are given.

25652 **(INIS-mf—11137) Annual research report, 1981-1982.** (Manitoba Univ., Winnipeg (Canada). Cyclotron Lab.). 1982. 208p. NTIS (US Sales Only), PC A10/MF A01. Order Number TI88701938/JAW.

Mapping of the magnetic field of the University of Manitoba Spiral Ridge Cyclotron took place during February and March, 1981, using 40 H/sup -/ beam settings and 30 D/sup -/ settings. This was made possible by the arrival of a new VAX 11-750 computer, which has revolutionised the experimental program. Of particular interest in the research program are the observation of evidence for sensitivity of the three nucleon system to the detailed nature of the two body force; the first measurement of the polarisation of neutrons emitted in a (p,n) reaction at the University; the detailed study of recoil polarisation following a direct reaction; and the separation of projectile and ejectile spin-dependent effects in nuclear reactions. The completion of a new Dee system enabling conversion of the accelerator to the push-push mode by the end of the year will make possible a major upgrading.

25653 **Data management IV supports two major on-line systems.** *Cadmat News;* 24-25(1 Apr 1984).

The General Electric Neutron Devices Department (GEND), under a prime contract with the US Department of Energy (DOE), designs, develops and manufactures special electronic and mechanical components. The dual responsibility of GEND not only results in complex administrative procedures, but also provides unique opportunities for modernization. As a government contractor, GEND benefits from the current vigorous pursuit of Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM). As a component of General Electric, GEND also benefits from Corporate Research and Development directed at factories with a future.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 25264

25654 **(ANL—88-11) Practical issues relating to the internal database predicates in an OR-parallel Prolog: Extensions and useful hacks.** Carlsson, M.; Danhof, K.; Overbeek, R. (Argonne National Lab., IL (USA)). Feb 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006971/JAW.

This technical report is being written to document and explain some of the insights the authors have gained during the implementation of two OR-parallel Prolog systems for shared-memory multiprocessors. We have been quite amazed by how much power and functionality can be achieved through the implementation of just a few primitive predicates. We introduce a few relatively trivial predicates which allow one to implement versions of findall/3, bagof/3, and setof/3 for the a multiprocessor environment. Then we show how these predicates can be used to implement AND-parallelism. Finally, we illustrate their use for implementing a limited notion of streams, and how such streams can be used to create a compiler that achieves excellent speedups for multiprocessors with a limited number of processors. 5 refs.

25655 **(ANL/MCS-TM—99) LAPACK Working Note No. 2: Block reduction of matrices to condensed forms for eigenvalue computations.** Dongarra, J.J.; Hammarling, S.J.; Sorensen, D.C. (Argonne National Lab., IL (USA). Mathematics and Computer Science Div.). Sep 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006943/JAW.

In this paper we describe block algorithms for the reduction of a real symmetric matrix to tridiagonal form and for the reduction of a general real matrix to either bidiagonal or Hessenberg form using Householder transformations. The approach is to aggregate the transformations and to apply them in a blocked fashion, thus achieving algorithms that are rich in matrix-matrix operations. These reductions to condensed form typically comprise a preliminary step in the computation of eigenvalues or singular values. With this in mind, we also demonstrate how the initial reduction to tridiagonal or bidiagonal form may be pipelined with the divide and conquer technique for computing the eigensystem of a symmetric matrix or the singular value decomposition of a general matrix to achieve algorithms which are load balanced and rich in matrix-matrix operations. 14 refs., 2 figs., 2 tabs.

25656 **(ANL/MCS-TM—102) A parallel algorithm for computing the singular value decomposition of a matrix.** Jessup, E.R.; Sorensen, D.C. (Argonne National Lab., IL (USA)). Dec 1987. Contract W-31109-ENG-38. 31p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88007059/JAW.

A parallel algorithm for computing the singular value decomposition will be presented. The basic step of the algorithm is a divide and conquer step based upon a rank one modification of a bidiagonal matrix. Numerical difficulties associated with forming the product of a matrix with its transpose are avoided and numerically stable formuale for obtaining left singular vectors after computing updated right singular vectors are derived. A deflation technique is described which together with a robust root finding method will assure computation of the singular values to full accuracy in the residuals and will also assure the orthogonality of the singular vectors. 16 refs., 2 figs.

25657 **(CONF-880424—2) The visit problem: Visibility graph-based solution.** Rao, N.S.V.; Iyengar, S.S.; deSaussure, G. (Louisiana State Univ., Baton Rouge (USA). Dept. of Computer Science; Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000343/JAW.

From IEEE international conference on robotics and automation; Philadelphia, PA, USA (25 Apr 1988).

The visit problem is defined as follows: a circular body R is located at point d_0 in a finite-sized two-dimensional terrain populated by a finite number of polygonal obstacles; each obstacle has a

finite number of vertices. The R is equipped with a sensor system capable of detecting all vertices and edges seen from it's present location. A computing device with storage capability is also housed on R. Initially, the R is located at a point d_0, and no terrain model is available to R. The R is capable of translational motion. The R is required to execute a navigational mission which involves visiting a sequence of the destination points, namely d1,d2...,d/sub M/, in the specified order. We present the algorithm LNAV that navigates R from d/sub i/ to d/sub i+1/. We prove the correctness of this algorithm, and also estimate its performance in terms of the number of scan operations, the distance traversed and the computational complexity. We then present the algorithm GNAV that executes the navigational mission. It uses LNAV in traversing in between successive destination points in the mission, and builds a global visibility graph of the terrain by integrating the sensor information obtained, over a period of time, as R keeps navigating. We validate and analyze the algorithm GNAV. We also illustrate that, in a general case of executing a navigation mission, the performance using GNAV is more efficient than the repeated application of LNAV in terms of number of scan operations and the distance traversed by R. 16 refs., 16 figs.

25658 **(DOE/ER/25015—2) Computer graphics tools for the study of minimal surfaces.** Callahan, M.; Hoffman, D.; Hoffman, J.T. (Massachusetts Univ., Amherst (USA)). Aug 1987. Contract FG02-86ER25015. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006421/JAW.

This paper discusses the use of computer graphics to represent the mathematical concepts of minimal surfaces. Analysis and examples of minimal surfaces are given. 23 refs., 16 figs. (LSP)

25659 **(DOE/ER/25015—3) Embedded minimal sufaces with an infinite number of ends.** Callahan, M.; Hoffman, D.; Meeks, W.H. III. (Massachusetts Univ., Amherst (USA)). Sep 1987. Contract FG02-86ER25015. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006429/JAW.

We prove the existence of an infinite family of periodic properly embedded minimal surfaces with an infinite number of annular ends. 25 refs., 29 figs.

25660 **(DOE/ER/25015—4) Regularity of the Albanese map for nonoriented surfaces.** Meeks, W.H. III. (Massachusetts Univ., Amherst (USA)). Sep 1987. Contract FG02-86ER25015. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006428/JAW.

This paper contains a generalization of the Jacobi imbedding theorem in classical Riemann surface theory. The main theorem gives necessary and sufficient conditions for the Albanese map of a closed nonorientable Riemannian surface to be a regular embedding of the surface into its Albanese variety. 7 refs.

25661 **(DOE/ER/25015—5) The inverse power method for semilinear elliptic equations.** Eydeland, A.; Spruck, J. (Massachusetts Univ., Amherst (USA)). Oct 1987. Contract FG02-86ER25015. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006427/JAW.

In this paper we develop globally convergent iterative algorithms for the solution of nonlinear eigenvalue problem $\Delta u + \lambda f(x,u) = 0$ in a bounded D. These algorithms are extremely useful in a wide variety of geometric and physical problems. 4 refs.

25662 **(DOE/ER/25015—7) Complete minimal surfaces in R^3 of low total curvature.** Barbanel, E.L. (Massachusetts Univ., Amherst (USA)). Sep 1987. Contract FG02-86ER25015. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006425/JAW.

In this paper we wish to determine all the complete minimal surfaces of genus zero and finite total curvature -8π in three-dimensional Euclidean space R^3. The surfaces are written down explicitly, using the Weierstrass representation. They are separated into parameter families of surfaces with the same number of ends and the same Gauss map. Pictures of representative members of each type are given. 12 refs., 16 figs., 5 tabs.

25663 **(DOE/ER/25015—8) Global spatial periodic solutions to the Ginzberg-Landau equations.** Yang, Yisong. (Massachusetts Univ., Amherst (USA)). Oct 1987. Contract FG02-86ER25015. 19p. NTIS, PC A03. Order Number DE88006424/JAW.

In this paper we study the global existence and nonexistence of spatially periodic solutions to the initial value problem of the Ginzburg-Landau equation. 15 refs.

25664 **(DOE/ER/25015—9) Almost-periodic solutions of nonlinear parabolic equations.** Yang, Yisong. (Massachusetts Univ., Amherst (USA)). Oct 1987. Contract FG02-86ER25015. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006423/JAW.

In this note the recent result of Corduneanu on almost periodicity of $L^2(G)$-bounded solutions of nonlinear parabolic equations is extended to the case when the nonlinear growth rate is beyond the first eigenvalue of the associated elliptic boundary value problem. 6 refs.

25665 **(DOE/ER/25015—10) A nonlinear parabolic equation of a wavenumber selection model in cellular flow.** Yang, Yisong. (Massachusetts Univ., Amherst (USA)). Oct 1987. Contract FG02-86ER25015. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006422/JAW.

A general study is presented for the nonlinear parabolic equation arising in a wavenumber selection problem in cellular flows. 11 refs.

25666 **(DOE/ER/25018—2) Numerical solution of nonlinear algebraic equations in stiff ODE solving: 1987-1988 technical progress report.** Walker, H.F. (Utah State Univ., Logan (USA)). 1988. Contract FG02-86ER25018. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88006634/JAW.

The primary objective of this project is to investigate numerical methods for solving particular systems of nonlinear algebraic equations, namely, those which arise in the implementation of implicit methods for stiff ODE initial-value problems. Many of the issues for these nonlinear systems also apply to more general nonlinear systems which share some of their characteristics, and during the last year this project has naturally come to involve a significant component of work directed toward such more general systems. Our model method for solving nonlinear systems is Newton's method, and this research has centered around two major variants of Newton's method which appear to offer special advantages in solving stiff ODE systems and similar systems. These are quasi-Newton methods, which employ secant updates of an approximate Jacobian, and "matrix-free" implementations of Newton's method, in which Newton steps are determined by approximately solving linear systems using "matrix-free" iterative methods. The quasi-Newton methods are intended for applications in which full-matrix techniques are admissible; the "matrix-free" methods are of interest primarily in the case of very large systems.

25667 **(DOE/ER/25026—18) Logarithmically connected, repetitive computer networks and numerical applications.** Gear, C.W. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Jan 1988. Contract FG02-87ER25026. 19p. (UILU-ENG—88-1706; UIUCDCS-R—88-1402). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88006632/JAW.

This note describes regular networks in Cartesian space which are such that any pair of nodes separated by a physical distance d have a connecting path which passes through no more than O(logd) intermediate nodes and yet which have no more than a bounded number of connections to any single node (as opposed to the hypercube, in which the number of connections increases logarithmically as the size of the network). The application of such networks to differential equations is discussed briefly. 2 refs., 4 figs.

25668 **(EGG-M—09286) Simulation in the support of eigenstructure assignment for interacting control loops.** Venhuizen, J.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 8p. (CONF-860638—5). NTIS, PC A02. Order Number DE88005545/JAW.

From American control conference; Seattle, WA, USA (18 Jun 1986).

Simulation lends confidence to the comparison of classical and eigenstructure assignment techniques to decouple interactive control loops. Examples for decoupling a second order interactive system by various methods are presented. The methods include: relative gain array, linear decoupling, active feedforward, and eigenstructure assignment methods. Simulated responses for an example of each of the decoupling methods are presented for setpoint changes and initial condition offsets. The examples show that only the eigenstructure method decouples the system responses to both types of perturbations. 13 refs., 18 figs.

25669 **(EGG-M—30286) Fundamentals of microprocessor-based design: A tutorial: Second edition.** Johnson, M.R. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1987. Contract AC07-76ID01570. 72p. (CONF-870556—3). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006761/JAW.

From 33. annual international instrumentation symposium; Las Vegas, NV, USA (3 May 1987).

Purpose of this tutorial is to give some idea of what can be done with small microprocessor-based systems, and an appreciation of performing function in real time. The topics are presented in logical sequence, one building on the last, rather than grouping all hardware and all software topics. Motorola's 6809 microprocessor is emphasized. We begin with the concept of programmed logic, then look at the basics of microcomputer architecture and data representation and then software topics looking at machine, assembly and high-level languages and where each would best be used. We then look at a subject often neglected in microprocessor courses - data structures. Imput/output devices and techniques are covered next. The tutorial concludes with a discussion of system development considerations and a quick survey of microprocessor/microcomputer families and capabilities.

25670 **(JAERI-M—87-186) VADMAP code to calculate the SAF of photon. Code description and the performance.** Yamaguchi, Yukichi; Togawa, Orihiko; Honma, Toshimitsu. (Japan Atomic Energy Research Inst., Tokyo). Nov 1987. 147p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88752330/JAW.

A computer code VADMAP has been developed to calculate the Specific Absorbed Fraction, SAF, of photon. The development of the code is aimed at efficient and systematic preparation of the SAF data files for several different human phantoms in a suitable form as a direct input data file to DOSimetric DAta Calculation system, DOSDAC, which is being developed at Japan Atomic Energy Research Institute, JAERI. This document describes the methodology used in the code, the code structure, user's information including the way of implementing the code on FACOM/M-380, and the performance through calculation and preparation of the SAF data file. In order to show the performance of the code, a set of the SAF values for an adult human phantom was calculated and was organized to prepare the SAF file. Comparing the calculated SAF values with those tabulated in ORNL-5000, the quality of the code was examined.

25671 **(KFK—4223) Applications of information technology in the environmental area.** Jaeschke, A.; Page, B. (eds.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Datenverarbeitung in der Technik; Hamburg Univ. (Germany, F.R.). Fachbereich 18 - Informatik). Mar 1987. 265p. (In German). (CONF-8609392—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88752262/JAW.

From Colloquium on applications of information technology in the environmental area; Karlsruhe, F.R. Germany (30 Sep 1986).

The state of events in the environment are described by physical, chemical, meteorological and biological data. The spatially distributed information cannot be managed without technical help from automatic measuring devices, data telecommunication and process data processing. The computer-aided creation of models and simulation represent an aid involving environmental problems. One considerable extension of the possibilities will be provided by the introduction of the methods of artificial intelligence, especially expert systems. The use of information technology therefore forms an important precondition for environmental protection. The contributions illustrate the state of development of communication between scientists in the field of environmental protection.

25672 **(LA-UR—87-2662) Nonlinear signal processing using neural networks: Prediction and system modelling.** Lapedes, A.; Farber, R. (Los Alamos National Lab., NM (USA)). Jun 1987. Contract W-7405-ENG-36. 52p. (CONF-8706130—4). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88006479/JAW.

From 1. IEEE international conference on neural networks; San Diego, CA, USA (21 Jun 1987).

The backpropagation learning algorithm for neural networks is developed into a formalism for nonlinear signal processing. We illustrate the method by selecting two common topics in signal processing, prediction and system modelling, and show that nonlinear applications can be handled extremely well by using neural networks. The formalism is a natural, nonlinear extension of the linear Least Mean Squares algorithm commonly used in adaptive signal processing. Simulations are presented that document the additional performance achieved by using nonlinear neural networks. First, we demonstrate that the formalism may be used to predict points in a highly chaotic time series with orders of magnitude increase in accuracy over conventional methods including the Linear Predictive Method and the Gabor-Volterra-Weiner Polynomial Method. Deterministic chaos is thought to be involved in many physical situations including the onset of turbulence in fluids, chemical reactions and plasma physics. Secondly, we demonstrate the use of the formalism in nonlinear system modelling by providing a graphic example in which it is clear that the neural network has accurately modelled the nonlinear transfer function. It is interesting to note that the formalism provides explicit, analytic, global, approximations to the nonlinear maps underlying the various time series. Furthermore, the neural net seems to be extremely parsimonious in its requirements for data points from the time series. We show that the neural net is able to perform well because it globally approximates the relevant maps by performing a kind of generalized mode decomposition of the maps. 24 refs., 13 figs.

25673 **(MU/MME—82) A study on modelling methodology illustrating principles and benefits in mineral and energy processing plants.** Finch, J.A.; Laplante, A.R. (McGill Univ., Montreal, Quebec (Canada). Dept. of Mining and Metallurgical Engineering). 1982. 177p. (MICROLOG—82-1550). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The purpose is to familiarize the potential modeller with some of the general concepts of modelling and simulation. The emphasis is on instruction by example. Four plant simulation case studies are examined and some of their common features identified and summarized as a guide to modelling methodology. A glossary of terms is provided and four appendices introduce some statistical principles of modelling. 27 figs., 17 tabs.

25674 **(SAND—82-1543-Rev.2) AGS/880 Menu System user guide.** Rios, M.A. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1988. Contract AC04-76DP00789. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88006690/JAW.

This document describes the AGS/880 Menu System. It uses a mylar menu overlay on the CADS terminal tablet which allows the user a more effective use of the system by providing a means to execute specific system commands or series of linked system commands. 11 figs., 7 tabs.

25675 (SAND—87-2616) SANDAC V software development guide. Borgman, C.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Feb 1988. Contract AC04-76DP00789. 437p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE88007011/JAW.

This report describes the software development environment for creating and debugging real-time software for the SANDAC V embedded computer. A complete description of the GATAR debugger, the Hawk runtime kernel and its Hawkeye task debugger is included. An abbreviated user's guide for the C cross-compiler and the cross assembler as well as the runtime libraries available for SANDAC V is included in the appendices to this document. 35 figs., 12 tabs.

25676 (SAND—88-0024) Process guidelines for Sandia WR software development. Schroeder, D.H.; Mangum, J.D. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1988. Contract AC04-76DP00789. 31p. NTIS, PC A03. Order Number DE88007136/JAW.

The Process Guidelines for Sandia WR Software Development define a general software methodology. This document provides a standard software development process for WR, and "WR like", programs. The guidelines are based on the Sandia Software Guidelines, the IEEE Software Engineering Standards, and the Sandia Engineering Procedures.

25677 (UCID—21313) Artificial neural networks: An introduction with an annotated bibliography. Vemuri, V. (Lawrence Livermore National Lab., CA (USA)). 27 Jan 1988. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007003/JAW.

Within the last decade tremendous progress has been made in our understanding of neurobiological models and our ability to fabricate optical and electronic circuits based on these models. These models are composed of numerous nonlinear computational elements fashioned as a network and operating in parallel. The prospect of using these networks to solve complex problems related to pattern recognition, image understanding and natural language understanding has never been brighter. With the recent spate of significant contributions from so many varied directions, leaders from both commercial and military sectors are placing heavy bets on the future of this emerging area. Although several bibliographies are available, there still is a need for a guide to help the novice walk through this area. This report is meant to fill this need.

25678 Implementation of the GMRES method using householder transformations. Walker, H.F. (Dept. of Mathematics, Utah State Univ., Logan, UT 84322-3900). *SIAM Journal on Scientific and Statistical Computing;* **9**: No. 1, 152-163(Jan 1988).

The standard implementation of the GMRES method for solving large nonsymmetric linear systems involves a Gram-Schmidt process which is a potential source of significant numerical error. An alternative implementation is outlined here in which orthogonalization by Householder transformations replaces the Gram-Schmidt process. This implementation requires slightly less storage but somewhat more arithmetic than the standard one; however, numerical experiments suggest that it is more stable, especially as the limits of residual reduction are reached. The extra arithmetic required may be less significant when products of the coefficient matrix with vectors are expensive or on vector and, in particular, parallel machines.

25679 Solving the Hodgkin-Huxley equations by a random walk method. Sherman, A.S.; Peskin, C.S. (National Institutes of Health, Bethesda, MD 20892). *SIAM Journal on Scientific and Statistical Computing;* **9**: No. 1, 170-190(Jan 1988).

A numerical method is describes for solving the Hodgkin-Huxley cable equations, set up as an initial boundary value problem. The method uses a gradient random walk combined with creation and destruction of the diffusing elements. It is designed to be efficient in the presence of sharp wavefronts. Details of implementation are given with particular emphasis on satisfying the boundary conditions without introducing excessive noise.

25680 Hypercube applications at Oak Ridge National Laboratory. Heath, M.T. (Mathematical Sciences Section, Oak Ridge National Lab., P.O. Box Y, Oak Ridge, TN 37831). pp 395-417 of Hypercube multiprocessors 1987. Heath, M.T. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8609173—). Contract AC05-84OR21400.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

To determine the viability of hypercube architectures for solving a broad spectrum of computational problems typically arising at Oak Ridge National Laboratory, a representative set of applications was chosen for implementation on a hypercube. The projects included finite element fracture analysis, cascade simulation, geochemical contaminant transport, image analysis, molecular dynamics of polymers, density functional theory, and nonlinear magnetohydrodynamics. Each project was a collaborative effort of scientists and engineers from the discipline in which the problem arose and experienced hypercube users from a parallel computing research group. Results of each of these projects and an overall summary are included in this report.

25681 Communication reduction in parallel sparse Cholesky factorization on a hypercube. George, A.; Liu, J.; Ng, E. (Mathematical Sciences Section, Oak Ridge National Lab., Oak Ridge, TN 37831). pp 576-586 of Hypercube multiprocessors 1987. Heath, M.T. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8609173—). Contract AC05-84OR21400.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

The authors consider the problem of reducing data traffic among processor nodes in the parallel factorization of a sparse matrix on a hypercube multiprocessor. A task assignment strategy based on the structure of an elimination tree is presented. This assignment is aimed at achieving load balancing among the processors and also reducing the amount of processor-to-processor data communication. Some experimental results on the performance of this scheme are presented.

25682 The parallel solution of triangular systems on a hypercube. Romine, C.H. (Engineering Physics and Mathematics Div., Mathematical Sciences Section, Oak Ridge National Lab., Oak Ridge, TN 37831-2009). pp 552-559 of Hypercube multiprocessors 1987. Heath, M.T. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8609173—). Contract AC05-84OR21400.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

It has been suggested by several authors that the parallel solution of an n x n triangular system of equations in which the coefficient matrix is assigned to the processors by columns is inherently inefficient on a local-memory multiprocessor. In this paper, a parallel inner-product formulation of the solution of a column-stored triangular system on a hypercube multiprocessor is presented and analyzed. Assuming synchronous, logarithmic communications, their model predicts that the inner-product algorithm should be nearly as efficient as the usual column-sweep algorithm applied to a row-stored system. The better performance exhibited empirically by the inner-product algorithm is attributed to the difference in the fan-in and fan-out operations. Empirical results for pipelined, ring communication are also given, showing that the two algorithms with ring communication are roughly equivalent in efficiency.

25683 Density functional theory and parallel processing. Ward, R.C.; Geist, G.A.; Butler, W.H. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 473-484 of Hypercube multiprocessors 1987. Heath, M.T. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8609173—). Contract AC05-84OR21400.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

The authors demonstrate a method for obtaining the ground state energies and charge densities of a system of atoms described within density functional theory using simulated annealing on a parallel computer.

25684 **Studies of random number generators for parallel processing.** Bowman, K.O.; Robinson, M.T. (Engineering Physics and Mathematics Div., P.O. Box Y, Oak Ridge National Lab., Oak Ridge, TN 37831-2009). pp 445-453 of Hypercube multiprocessors 1987. Heath, M.T. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8609173—). Contract AC05-84OR21400.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

If Monte Carlo calculations are to be performed in a parallel processing environment, a method of generating appropriate sequences of pseudorandom numbers for each process must be available. Others proposed an elegant algorithm based on the concept of pseudorandom or Lehmer trees: the sequence of numbers from a linear congruential generator is divided into disjoint subsequences by the members of an auxiliary sequence. One subsequence can be assigned to each process. Extensive tests show the algorithm to suffer from correlations between the parallel subsequences: this is a result of the small number of bits which participate in the auxiliary sequence and illustrates the well-known discovery of Marsaglia. Two alternative algorithms are proposed, both of which appear to be free of interprocess correlations. One relaxes the conditions on the Lehmer tree by using an arbitrary auxiliary multiplier; it is not known to what extent the subsequences are disjoint. The other partitions the main sequence into disjoint subsequences by sending one member to each process in turn, minimizing interprocess communication by defining new sequence generating parameters.

25685 **Virtual-time operating-system functions for robotics applications on a hypercube.** Einstein, J.R.; Barhen, J.; Jefferson, D. (Center for Engineering Systems Advanced Research, Oak Ridge National Lab., Oak Ridge, TN 37831). pp 100-107 of Hypercube multiprocessors 1987. Heath, M.T. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8609173—). Contract AC05-84OR21400.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

Hypercube multiprocessors used in autonomous robots carrying out time-critical tasks in unpredictable environments require special operating-system functions to provide the capability of rapid response to unforeseen external events. A "virtual-time" shell having such capabilities is under design for the Vertex operating system of the NCUBE hypercube computer.

25686 **A UNIX interface to supercomputers.** McBryan, O.A. (C-3, MS-B265, Los Alamos National Lab., Los Alamos, NM 87545). pp 147-157 of New computing environments: Microcomputers in large-scale computing. Wouk, A. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8505216—). Contract AC02-76ER03077.

From Workshop on microcomputers in large scale scientific computing; Newark, DE, USA (20 May 1985).

The authors describe a convenient interface between UNIX-based work-stations or minicomputers, and supercomputers such as the CRAY series machines. Using this interface, the user can issue commands entirely on the UNIX system, with remote compilation, loading and execution performed on the supercomputer. The interface is not a remote login interface. Rather the domain of various UNIX utilities such as compilers, archivers and loaders are extended to include the supercomputer. The user need know essentially nothing about the supercomputer operation system, commands or filename restrictions. Standard UNIX utilities will perform supercomputer operations transparently. UNIX command names and arguments are mapped to corresponding supercomputer equivalents, suitable options are selected as needed, UNIX directory tree filenames are coerced to allowable supercomputer names and all source and output files are automatically transferred between the machines. The primary purpose of the software is to allow the programmer to benefit from the interactive features of UNIX systems including screen editors, software maintenance utilities such as make and SCCS, and various text manipulation utilities. The interface was designed particularly to support development of very large multi-file programs, possibly consisting of hundreds of files and hundreds of thousands of lines of code. All supercomputer source is kept on the work-station.

25687 **Using supercomputers as attached processors.** McBryan, O.A. (C-3, MS-B265, Los Alamos National Lab., Los Alamos, NM 87545). pp 130-146 of New computing environments: Microcomputers in large-scale computing. Wouk, A. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8505216—). Contract AC02-76ER03077.

From Workshop on microcomputers in large scale scientific computing; Newark, DE, USA (20 May 1985).

The authors developed software that allows one or more supercomputers to be used as an attached processor by programs running on a mini-computer. In typical use, programs are run as distributed tasks, with the supercomputer performing floating-point intensive computation and the mini-computer providing access to the richer set of software and languages typically available on such machines. In one application, a 200,000 line C program running on a VAX 780 used a CRAY supercomputer to solve systems of liner equations at high speed, resulting in a 5-fold speedup in execution time on the VAX. The same software is used to distribute a computation over several mini-computers or work-stations on a local area network. In this application one computer acts as the master, distributing computational tasks to the other slave processors in parallel. A third application involves an FPS-164 array processor which is tightly coupled to a VAX/780. Using the software described, the FPS-164 is made available to other computers on a local area network, including machines running UNIX or other operating systems for which FPS-164 software is not available. A similar application provides access to an Alliant multiprocessor from a network of minicomputers and work-stations.

25688 **Optimization on microcomputers: The Nelder-Mead simplex algorithm.** Dennis, J.E.; Woods, D.J. (Mathematical Sciences Dept., Rice Univ., Houston, TX 77251). pp 116-122 of New computing environments: Microcomputers in large-scale computing. Wouk, A. Philadelphia, PA; Society for Industrial and Applied Mathematics (1987). (CONF-8505216—).

From Workshop on microcomputers in large scale scientific computing; Newark, DE, USA (20 May 1985).

In this paper the authors describe the Nelder-Mead simplex method for obtaining the minimizer of a function. The Nelder-Mead algorithm has several properties that make it a natural choice for implementation and utilization on microcomputers. Stopping criteria for the method are presented as well as a brief discussion of the convergence properties of the method. An algorithmic statement of the method is included as an appendix.

25689 **Algorithm 592. A FORTRAN subroutine for computing the optimal estimate of f(x).** Gaffney, P.W. (Oak Ridge National Lab., TN). *ACM Transactions on Mathematical Software;* **9**: No. 1, 98-116(Mar 1983). Contract W-7405-ENG-26.

In this paper they present a FORTRAN subroutine to compute the solution of the following problem. Given values of an unknown function f at n distinct points, $x_1 < x_2 < \ldots <$ x/sub n-1/ $<$ x/sub n/, and given an integer k, $1 \leq k \leq n$, and a finite bound on the kth derivative of f, parallel to f/sup (k)/ parallel to ∞ identical with max absolute value of (f/sup (k)/(x)) $\leq L < \infty$, $x_1 \leq x \leq$ x/sub n/, determine the rate of possible values of f(a) (and hence the optimal estimate of f(a)), where A is any point in the interval $x_1 \leq x \leq$ x/sub n/.

9903 Information Handling

25690 **(EML—500) A data acquisition system for atmospheric tracer studies.** Polito, M. (USDOE Environmental Measurements Lab., New York). Dec 1987. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006211/JAW.

An unusual data acquisition scheme is described for storing information electronically without the use of a microprocessor. The system had to be small and use low power devices to fit within battery operated field instruments. 6 figs.

9904 Law

25691 **(INIS-mf—11131) Atomic Energy Control Board policy and procedures on representations and appearances.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 16 May 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701934/JAW.

The Atomic Energy Control Board (AECB) recognizes that in fulfilling its regulatory responsibilities it should give interested parties (applicants, licensees, one or more members of the public, or a special interest group) an opportunity to express their views on matters before the Board. It is prepared to receive written statements of views, and in certain cases to grant appearances before the President and appropriate AECB staff or at meetings of the Board. This document prescribes the policies and procedures to be followed in making representations to the Board.